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# THESIS

COMPUTER PROGRAMS FOR HELICOPTER DATA DISPLAY AND CONCEPTUAL DESIGN

by

Gary M. Bishop

December 1983

Thesis Advisor: Donald M. Layton

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This thesis allows a person with access to a computer that uses the FORTRAN language and that is equipped with the DISSPLA software system the ability to select and graphically portray for analysis the critical design parameters of actual helicopters. It also allows a person with access to any computer

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that uses the FORTRAN language the ability to do a complete conceptual design of a helicopter at one sitting in accordance with the procedures in the Helicopter Design Manual published as course notes for the AE 4306 Helicopter Design course at the Naval Postgraduate School.

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# Computer Programs for Helicopter Data Display and Conceptual Design

by

Gary M. Bishop
Captain, United States Army
B.S., United States Military Academy, 1975

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN AERONAUTICAL ENGINEERING

from the

NAVAL POSTGRADUATE SCHOOL
December 1983

516

# ABSTRACT

This thesis allows a person with access to a computer that uses the FORTRAN language and that is equipped with the DISSPLA software system the ability to select and graphically portray for analysis the critical design parameters of actual helicopters. It also allows a person with access to any computer that uses the FORTRAN language the ability to do a complete conceptual design of a helicopter at one sitting in accordance with the procedures in the Helicopter Design Manual published as course notes for the AE 4306 Helicopter Design course at the Naval Postgraduate School.

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# I. INTRODUCTION

## A. BACKGROUND

The helicopter industry, as in most industries, incorporates many of the attributes of its previous designs into its new products. New aircraft are generally built upon the successes of previous designs with minor changes due to technological advances. These technological advances usually relate to new materials and new methods of control but hardly ever result in drastic changes to the aerodynamic surfaces. These proven designs of the integral parts which have specific aerodynamic characteristics are well documented and extremely useful in the design process. It is essential for the designer to have this corporate knowledge of design trends for the design process as well as for the validation of his design. This knowledge of design trends is necessary for both the designer in industry and the student in a learning environment.

Outside of specific helicopter companies, little has been done to analyze the interrelationships that exist between design parameters. These interrelationships provide a bases for the simplification of assumptions and validation of design results. This knowledge needs to be available to

the design student just as it is to the design engineer so that the information can be used for an analysis or verfication during the design process. Therefore, it is important that this information be readily available and that the student have quick, easy and well defined access to this information.

The retrieval and analysis of historical data is but one part of the design process. The critical part is the actual process whereby a conceptual design is accomplished through many iterations. This process is long and involved but provides the design student with a basic understanding of the design process. For a more indepth study of the design process it is necessary for the student to vary as many of the design parameters as possible in order to see the interrelationships that exist. This process also allows the student to become intimately familiar with the problems and needs of the designer.

To date, no known programs for the IBM 3033 have been prepared that will take the design student through the entire process from historical analyses to conceptual design completion.

## B. GOALS

The objective of this study was to develop an interactive capability for the design student using the IBM 3033 computer. The program, if used at the Naval Postgraduate School, should be capable of providing graphical representations of the critical data necessary for a proper analysis in the data analysis phase. During the conceptual design phase the program should allow for design student/computer interaction so that the design student can readily see the effects of varying critical parameters. To maximize the assets available at the Naval Postgraduate School, the Tektronix 618 dual screen system and the DISSPLA [Ref. 1] software system should be incorporated in the structuring of the computer programs.

The programs should be designed primarily for the use of Aeronautical Engineering students at the Naval Postgraduate School enrolled in the Helicopter Performance, Helicopter Design, and Advanced Helicopter Design courses.

# II. APPROACH TO THE PROBLEM

## A. INTRODUCTION

The basic approach was to write two computer programs utilizing the DISSPLA software system for use on the IBM 3033 using FORTRAN IV. The programs are completely interactive, prompting the user for all necessary information and then graphically depicting the information in the form of tables on the IBM 3278 screen or as a graph on either the Tektronix 618 screen or by use of the VERSATEC plotter. If the Tektronix machine is used, the displayed graph can be copied directly using electrostatic copiers attached to each machine.

## B. ANALYSIS OF HELICOPTER DESIGN DATA

The first program consists of a historical data display system that takes thirty critical design parameters and allows the user to select the parameters for analysis. The user can then specify the page format as well as the number of graphs per page of the finished graph. Subroutines within the program are as follows:

1. Block data
2. Data point identification
3. Graphical display formatting

### C. CONCEPTUAL HELICOPTER DESIGN

The second program is written to correspond procedurally WITH THE Helicopter Design Manual [Ref. 2] used in the AE 4306 Helicopter Design course at the Naval Postgraduate School. The formulae necessary for the computation of each section is provided in lieu of subroutine use. This allows for quick and easy updating of the program as it becomes necessary. Also, if the student desires, it can be seen how the data that is received is computed. This program is completely interactive and requires only that the student have the information listed on the design specification sheet and the accompanying charts and references necessary for the required decisions during the design process. All tables and graphs are generated and displayed either on the IBM 3278 screen or the Tektronix 618 screen. Output for the tabular data is provided on a separate file and the single graph needed for design decisions can be obtained using the electrostatic printers.

Detailed knowledge of the IBM 3033 computer is not necessary. A familiarity of helicopter aerodynamics and performance is, however, necessary for proper utilization of the program in order to obtain meaningful design information.

# III. SOLUTIONS TO THE PROBLEMS

## A. DATA DISPLAY PROGRAM

Table I lists the thirty critical design parameters used most often in any analysis of an aircrafts performance as found in the Helicopter Performance Manual [Ref. 3].

TABLE I

Design Parameters

Main rotor radius
Tail rotor radius
Number of main rotor blades
Number of tail rotor blades
Height of the main rotor system
Speed of the main rotor
Speed of the tail rotor
Chord of the main rotor
Chord of the tail rotor
Span of the main rotor
Span of the tail rotor
Twist of the main rotor blade
Twist of the tail rotor blade
Profile drag of the main rotor blade
Profile drag of the tail rotor blade
Disc loading of the main rotor system
Width of the fuselage
Length of the fuselage
Frontal equivalent flat plate area
Vertical equivalent flat plate area
Maximum forward velocity
Maximum range
Rate of climb
Hover ceiling (IGE)
Hover ceiling (OGE)
Length of the tail
Operating weight
Load weight
Fuel weight
Maximum gross weight

The above parameters have been deemed those most critical to the design process. The airfoil data has been extrapolated from NACA data and the specific helicopter

performance parameters have been extrapolated from the various manuals for the specific helicopters. Tables III through X, Appendix C, list the specific data utilized for the study.

Table II lists the helicopters used for the analysis portion of the graphing.

TABLE II

Representative Helicopters

| Military Designator | Weight Classification | Branch of Service |
|---|---|---|
| AH-64 | Medium | USA |
| OH-6A | Light | USA |
| SH-3H | Medium | USN |
| S-76 | Medium | USN |
| UH-60A | Medium | USA/USN |
| CH-54B | Heavy | USA |
| CH-53D | Heavy | USN |
| CH-53E | Heavy | USN |

All the helicopters selected for study were single main rotor helicopters that are still in the active inventories of the agencies listed. The selections were made with deference to aircraft of the U.S. Army and U.S. Navy and then to a representative sampling of the three major weight classifications.

The data from Tables III through X can now be graphed in the following combinations using the Data Display program:

1. Simple X-Y plot

    a. Horizontal page format (11 X 8.5 inches)
    b. Vertical page format (8.5 X 11 inches)
2. Two parameters versus a third
    a. Horizontal page format (11 X 8.5 inches)
        (1) Two axes on the abscissa scale
        (2) Two axes on the ordinate scale
    b. Vertical page format (8.5 X 11 inches)
        (1) Two axes on the abscissa scale
        (2) Two axes on the ordinate scale
3. Two X-Y plots on the same page with a horizontal page format
4. Three parameters versus one common parameter with a vertical page format
5. Four separate X-Y plots on the same page with a horizontal page format

Figures 3.1. through 3.9., Appendix C, illustrate the capability of the program. The program was devised so as to allow the greatest flexibility for the analyst as to the graphical presentation.

## B. CONCEPTUAL DESIGN PROGRAM

The design process is in accordance with the procedural steps as outlined in the _Helicopter Design Manual_. The

program is devised so as to allow the design student the ability to do a complete conceptual design at one sitting if he is properly prepared. The program lists all critical tables and information necessary for doing an analysis of the design and also provides the necessary information to prepare a written report. If the Tektronix dual screen combination is used, the student has a graphical representation of the total power curve at altitude presented to him which must be used to extrapolate critical design performance parameters. Figure 3.10. is a sample of the graphical representation provided. Sample output is provided in Appendix B to illustrate the capabilities of the program and the possible usefulness to the design student.

# IV. RESULTS AND CONCLUSIONS

## A. DATA DISPLAY PROGRAM

This program provided good results in use for the analyses of the design parameters considered, particularly in the correlation between commonly used 'rules of thumb' and graphical analyses of the same parameters.

The capability of the program could be enhanced in several ways. First, additional single main rotor helicopters could be added to enable a more complete analysis to be accomplished. Second, the use of different scales, such as the logrithmic scale, for the graphical analysis could prove to be more suitable for some of the parameters. Third, additional parameters that other companies have compiled in their technical manuals could be added for analysis.

## B. CONCEPTUAL DESIGN PROGRAM

This program provided information consistent with existing aircraft. The interactive characteristic of the program allows the student to actively participate in the design process and, most importantly, the program allows the student to vary parameters and see the effects of changing a

single parameter on the entire design process. If the student was prepared and had all the appropriate references, this process need only take an hour to complete one iteration of the entire process. This allows for multiple iterations, optimization, and parameter variation.

One problem with the program is that it is only as good as the assumptions that have been made for the model to simplify the formulae used as given in Reference 3. A crude approximation to existing aircraft can be made with the understanding that the aircraft designed during this process is merely a conceptual design and the beginning step in the process for the final product. This model has been developed so that changes made to the course can be incorporated easily and that any corrections can be made quickly. This program also can be run on any FORTRAN capable computer using the coding listed in Appendix B.

# APPENDIX A

## A. USERS GUIDE TO THE DATA DISPLAY PROGRAM

The program has been written with the user in mind. It is completely interactive once the program has been loaded into the DISSPLA mode so that the user need only read the instructions presented on the screen carefully.

Use the following procedure to invoke the Data Display program once the Fortran program resides on the users disk.

1. Logon as normal at either a regular IBM 3278 terminal or at a Tektronix 618 dual screen terminal

2. Obtain the use of temporary storage space by entering the following:

   `DEFINE STORAGE 1M (enter)`

3. When the PSW '00020000 00000000' appears on the screen type in:

   `I CMS (enter)`

4. If the program has not been previously compiled on your disk type in:

   `FORTGI HELODATA (enter)`

5. When the program has been compiled you are ready to enter into DISSPLA by typing in:

   `DISSPLA HELODATA (enter)`

6. Follow the instructions given on the screen. If you desire a hard copy of the graphs do the following:

   IBM terminal--Exit the program and enter DISSPOP and then follow the instructions

TEK terminal--Press the hard copy button on the large monitor

## B. PROGRAM NOMENCLATURE

| MNEMONIC | DEFINITION |
|---|---|
| ANS | General variable for reading keyboard answers |
| B | Number of main rotor blades |
| BTR | Number of tail rotor blades |
| C | Chord of a main rotor blade in feet |
| CDO | Profile drag of a main rotor blade section |
| CDOTR | Profile drag of a tail rotor blade section |
| CTR | Chord of a tail rotor blade in feet |
| DL | Disc loading of the main rotor system |
| FH | Frontal effective flat plate area in square feet |
| FV | Vertical effective flat plate area in square feet |
| FWT | Fuel weight in pounds |
| HOVIGE | Hover ceiling (in ground effect) in feet |
| HOVOGE | Hover ceiling (out of ground effect) in feet |
| HT | Height of the main rotor system above the ground in feet |
| I | Do loop variable |
| IPAK | Array for packing legend information |
| KINDS | Array for packing legend information |
| LGH | Length of the fuselage in feet |
| LT | Length of the tail in feet |

| | |
|---|---|
| LWT | Load weight in pounds |
| MGW | Maximum gross weight in pounds |
| OPTION | Term used in Switch subroutine for page formatting |
| OWT | Operating weight in pounds |
| PANS | References page format selection |
| R | Main rotor radius in feet |
| RC | Maximum rate of climb in feet per minute |
| RNG | Maximum range in nautical miles |
| RPM | Speed of the main rotor system in RPM |
| RPMTR | Speed of the tail rotor system in RPM |
| RS | Span of a main rotor blade in feet |
| RSTR | Span of a tail rotor blade in feet |
| RTR | Tail rotor radius in feet |
| TEMP1 | Dummy parameter returned from subroutine |
| TEMP2 | Dummy parameter returned from subroutine |
| TEMP3 | Dummy parameter returned from subroutine |
| TITALT | Program trip used in multiple axes plotting |
| TWOAX | References which axis has two axes plotted |
| TWST | Twist of a main rotor blade in degrees |
| TWSTR | Twist of a tail rotor blade in degrees |
| VM | Maximum velocity in knots |
| WDT | Width of the fuselage in feet |
| X | Array returned from Switch subroutine containing abscissas for plotting |

| | |
|---|---|
| XANS | Answer referenced to X axis selection |
| XANS1 | Answer referenced to multiple X axes selection |
| XANS2 | Answer referenced to multiple X axes selection |
| XMAX | Maximum value of abscissa desired for plotting |
| XORIG | Minimum value of abscissa desired for plotting |
| XPOS | Array of values referencing subplot locations of abscissas |
| XSTP | Increment size between minimum and maxium of the abscissa axis |
| XTWO | Array returned from Switch subroutine containing abscissas for plotting |
| X2ANS | Array for X axis answers for two graph option |
| X4ANS | Array for X axis answers for four graph option |
| Y | Array returned from Switch subroutine containing ordinates for plotting |
| YANS | Answer referenced to Y axis selection |
| YANS1 | Answer referenced to multiple Y axes selection |
| YANS2 | Answer referenced to multiple Y axes selection |
| YMAX | Maximum value of abscissa desired for plotting |
| YORIG | Minimum value of ordinate desired for plotting |
| YPOS | Array of values referencing subplot locations of ordinates |
| YSTP | Increment size between minimum and maxium of the abscissa axis |
| YTWO | Array returned from Switch subroutine containing ordinates for plotting |
| Y2ANS | Array for Y axis answers for two graph option |
| Y3ANS | Array for Y axis answers for three graph option |

| | |
|---|---|
| Y4ANS | Array for Y axis answers for four graph option |
| Z | Array in subroutine switch for parameters |

## C. PROGRAM LISTING

```
      REAL R(8),RTR(8),B(8),BTR(8),HT(8),RPM(8),RPMTR(8),C(8),CTR(8)
      REAL RS(8),RSTR(8),TWST(8),TWSTTR(8),CDO(8),CDOTR(8),DL(8)
      REAL WCT(8),LGH(8),FH(8),FV(8),VM(8),RNG(8),RC(8),HOVIGE(8)
      REAL HOVOGE(8),LT(8),OWT(8),LWT(8),FWT(8),MGW(8)
      REAL YORIG,YSTP,YMAX,XORIG,XSTP,XMAX,XANS,YANS,XANS1,XANS2,X3ANS,Y
     1ANS2,YANS2,TITALT,TWOAX,ANS,PANS,XTWO
     2(8),YTWO(8),TEMP1,TEMP2,TEMP3,XPOS(9),YPOS(9),Y3ANS(3),X4ANS(4),Y4
     3ANS(4),X2ANS(2),Y2ANS(2),X(8),Y(8)
      INTEGER I,KINDS(200),IPAK(200)
      DATA XPOS/1.5,6.5,1.,1.,1.,1.,6.5,1.,6.5/
      DATA YPOS/1.,1.,1.,3.75,6.5,1.,1.,4.,4./
      COMMON /C1/ R,RTR,B,BTR,HT,RPM,RPMTR,C,CTR,RS,RSTR,TWST,TWSTTR,CDO
     1,CDOTR,DL,WCT,LGH,FH,FV,VM,RNG,RC,HOVIGE,HOVOGE,LT,OWT,LWT,FWT,MGW
C*********************************************************************
C THIS SECTION DETERMINES WHICH TYPE OF TEKTRONIX EQUIPMENT THAT YOU  *
C ARE USING AND MAKES THE APPROPRIATE CALLS TO BRING THE SYSTEM ON    *
C LINE                                                                *
C*********************************************************************
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,370)
      WRITE (6,380)
      READ (5,*) ANS
      IF (ANS.NE.1.) GO TO 360
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,390)
      READ (5,*) ANS
      CALL FRTCMS ('CLRSCRN 6')
      IF (ANS.NE.1.) GO TO 10
      CALL TEK618
      GO TO 30
10    IF (ANS.NE.2.) GO TO 20
      CALL TEKALL (4662,30,31,1,0)
      GO TO 30
20    IF (ANS.NE.3.) GO TO 340
      CALL COMPRS
30    CONTINUE
      CALL SWISSL
      CALL SETCLR ('BLACK')
      CALL HEIGHT (.1)
C*********************************************************************
C THIS PORTION    PACKS THE INFORMATION INTO AN ARRAY SO THAT A STORY  *
C CAN BE PRINTED ONTO EACH GRAPH WITH THE MEANING OF THE NUMBERS THAT *
C LABELS GIVE FOR EACH PLOT                                           *
C*********************************************************************
      CALL LINES ('1. AH-64    5. UH-60A$',KINDS,1)
```

```
      CALL LINES ('2. OH-6A    6. CH-54B$',KINCS,2)
      CALL LINES ('3. SH-3H     7. CH-53D$',KINDS,3)
      CALL LINES ('4. S-76       8. CH-54E$',KINDS,4)
      CALL RESET ('HEIGHT')
      CALL MAFKER (15)
      CALL SHCCHR (90.,1,0.002,1)
      CALL HWSCAL ('SCREEN')
C***********************************************************************
C THIS SECTICN ALLOWS THE USER TO SELECT IF THEY WANT 1 GRAPH, 2        *
C GRAPHS HORIZONTALLY SIDE BY SIDE, 3 GRAPHS VERTICALLY WITH THE SAME   *
C X AXIS OR FCUR CRAPHS ON THE SAME PAGE.                               *
C***********************************************************************
      WRITE (6,40C)
      READ (5,*) ANS
      CALL FRTCMS ('CLRSCRN 6')
      IF (ANS.NE.1.0) GO TO 280
C***********************************************************************
C THIS SECTICN PRESENTS THE 30 DIFFERENT PARMATERS THAT CAN BE USED IN *
C COMPARISONS AND ALLOWS THE USER TO SELECT UP TO 3 FOR COMPARISON     *
C***********************************************************************
      TITALT=C.0
      WRITE (6,410)
      WRITE (6,42C)
      READ (5,*) ANS
      CALL FRTCMS ('CLRSCRN 6')
C***********************************************************************
C IF ONLY 2 PARAMTERS ARE SELECTED , A CHOICE OF PAGE FORMAT IS GIVEN  *
C AND A CHOICE OF WHICH PARAMTER IS TO BE ON WHICH AXIS IS GIVEN.      *
C SUBROUTINES ARE CALLED WHICH CHANGE THE PARMATER SELECTED VALUES INTO*
C VALUES TO BE PLCTTED ALONG WITH THEIR RESPECTIVE PLOTTING INFORMATION*
C***********************************************************************
      IF (ANS.NE.2.) GO TO 60
      WRITE (6,43C)
      READ (5,*) ANS
      CALL FRTCMS ('CLRSCRN 6')
      IF (ANS.NE.1.) GO TO 40
      WRITE (6,54C)
      READ (5,*) ANS
      IF (ANS.NE.1.) GO TO 340
      CALL FRTCMS ('CLRSCRN 6')
      CALL PAGE (11.,8.5)
      CALL AREA2D (9.,6.)
      CALL HEIGHT (.3)
      CALL MESSAG ('HELICOPTER DESIGN$',-100,0.,6.5)
      CALL RESET ('HEIGHT')
      CALL MESSAG ('AE 4306/4900$',100,1.2,6.25)
      CALL HEIGHT (.1)
      CALL LSTORY (KINDS,4,7.25,6.25)
```

```
      CALL RESET ('HEIGHT')
      GO TO 50
40    IF (ANS.NE.2.) GO TO 340
      WRITE (6,550)
      READ (5,*) ANS
      IF (ANS.NE.1.) GO TO 340
      CALL FRTCMS ('CLRSCRN 6')
      CALL PAGE (8.5,11.)
      CALL HWROT ('AUTO')
      CALL AREA2D (6.,8.)
      CALL HEIGHT (.3)
      CALL MESSAG ('HELICOPTER DESIGN$',-100,0.,8.5)
      CALL RESET ('HEIGHT')
      CALL MESSAG ('AE 4306/4900$',100,1.2,8.25)
      CALL LSTORY (KINDS,4,4.25,8.25)
50    CONTINUE
      WRITE (6,410)
      WRITE (6,440)
      READ (5,*) XANS,YANS
      CALL FRTCMS ('CLRSCRN 6')
      CALL FRAME
      CALL XAXEND ('NCENDS')
      CALL YAXEND ('NCENDS')
      CALL SWITCH (XANS,1.,X,XORIG,XSTP,XMAX)
      CALL SWITCH (YANS,2.,Y,YORIG,YSTP,YMAX)
      CALL GRAF (XORIG,XSTP,XMAX,YORIG,YSTP,YMAX)
      CALL RESET ('XTICKS')
      CALL RESET ('YTICKS')
      CALL CURVE (X,Y,8,-1)
      CALL LABEL (X,Y)
      TITALT=0.0
      GO TO 180
C***********************************************************************
C SINCE 3 PARAMETERS WERE CHOSEN, THE USER IS GIVEN A CHOICE OF PAGE   *
C FORMAT (HORIZONTAL OR VERTICAL) AND WHICH AXIS HE WANTS TO HAVE TWO  *
C SCALES LOCATED ON.  SUBROUTINES ARE USED WHICH PROVIDE A SELECTION   *
C OF DESIRED PARAMTERS AND CALL THEIR APPROPRIATE FORMATS AND RETURN   *
C VALUES TO BE PLOTTED.  A SECOND SET OF DATA FOR ONE AXIS MUST BE     *
C DEFERRED DUE TO DISSPLA LEVEL REQUIREMENTS, THEREFORE, A VARIABLE    *
C HAS BEEN DESIGNATED TO TRIP A LATER SUBROUTINE WHERE THE ADDITIONAL  *
C CALL TO A SUBROUTINE FOR ADDITIONAL AXES CAN BE MADE                 *
C***********************************************************************
60    CONTINUE
      CALL HEIGHT (.1)
      CALL MYLEGN (' ',1)
      CALL SETCLR ('RED')
      CALL LINES ('PRIMARY AXES$',IPAK,1)
      CALL SETCLR ('GREEN')
```

```
      CALL LINES ('SECONDARY AXES$',IPAK,2)
      CALL SETCLR ('BLACK')
      CALL RESET ('HEIGHT')
      IF (ANS.NE.3.) GO TO 340
      WRITE (6,430)
      READ (5,*) PANS
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,450)
      READ (5,*) TWOAX
      CALL FRTCMS ('CLRSCRN 6')
      IF (PANS.NE.1.) GO TO 70
      IF (TWOAX.NE.1.) GO TO 110
      GO TO 90
70    IF (PANS.NE.2.) GO TO 340
      IF (TWOAX.NE.1.) GO TO 80
      GO TO 130
80    IF (TWOAX.NE.2.) GO TO 340
      GO TO 150
90    CONTINUE
      WRITE (6,560)
      READ (5,*) ANS
      IF (ANS.NE.1.) GO TO 340
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,410)
      WRITE (6,460)
      READ (5,*) XANS1,XANS2,YANS
      CALL FRTCMS ('CLRSCRN 6')
      CALL PAGE (11.,8.5)
      CALL PHYSOR (1.5,2.)
      CALL AREA2D (9.,5.)
      CALL HEIGHT (.3)
      CALL MESSAG ('HELICOPTER DESIGN$',-100,0.,5.5)
      CALL RESET ('HEIGHT')
      CALL MESSAG ('AE 4306/4900$',100,1.2,5.25)
      CALL LSTCRY (KINDS,4,7.25,5.25)
      CALL SWITCH (XANS1,1.,X,XORIG,XSTP,XMAX)
      CALL SWITCH (YANS,2.,Y,YORIG,YSTP,YMAX)
      DO 100 I=1,8
      YTWO(I)=Y(I)
100   CONTINUE
      TITALT=1.0
      GO TO 170
110   CONTINUE
      WRITE (6,570)
      READ (5,*) ANS
      IF (ANS.NE.1.) GO TO 340
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,410)
```

```
      WRITE (6,470)
      READ (5,*) XANS,YANS1,YANS2
      CALL FRTCMS ('CLRSCRN 6')
      CALL PAGE (11.,8.5)
      CALL PHYSOR (2.5,1.0)
      CALL AREA2D (7.5,6.)
      CALL HEIGHT (.3)
      CALL MESSAG ('HELICOPTER DESIGN$',-100,0.,6.5)
      CALL RESET ('HEIGHT')
      CALL MESSAG ('AE 4306/4900$',100,1.2,6.25)
      CALL LSTORY (KINDS,4,5.75,6.25)
      CALL SWITCH (XANS,1.,X,XORIG,XSTP,XMAX)
      CALL SWITCH (YANS1,2.,Y,YORIG,YSTP,YMAX)
      DO 120 I=1,8
      XTWO(I)=X(I)
120   CONTINUE
      TITALT=2.0
      GO TO 170
130   CONTINUE
      WRITE (6,580)
      READ (5,*) ANS
      IF (ANS.NE.1.) GO TO 340
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,410)
      WRITE (6,460)
      READ (5,*) XANS1,XANS2,YANS
      CALL FRTCMS ('CLRSCRN 6')
      CALL PAGE (8.5,11.)
      CALL HWROT ('AUTO')
      CALL PHYSOR (1.5,2.)
      CALL AREA2D (6.5,7.5)
      CALL HEIGHT (.3)
      CALL MESSAG ('HELICOPTER DESIGN$',-100,0.,8.)
      CALL RESET ('HEIGHT')
      CALL MESSAG ('AE 4306/4900$',100,1.2,7.75)
      CALL LSTORY (KINDS,4,4.75,7.75)
      CALL SWITCH (XANS1,1.,X,XORIG,XSTP,XMAX)
      CALL SWITCH (YANS,2.,Y,YORIG,YSTP,YMAX)
      DO 140 I=1,8
      YTWO(I)=Y(I)
140   CONTINUE
      TITALT=3.0
      GO TO 170
150   CONTINUE
      WRITE (6,590)
      READ (5,*) ANS
      IF (ANS.NE.1.) GO TO 340
      CALL FRTCMS ('CLRSCRN 6')
```

```
      WRITE (6,410)
      WRITE (6,470)
      READ (5,*) XANS,YANS1,YANS2
      CALL FRTCMS ('CLRSCRN 6')
      CALL PAGE (8.5,11.)
      CALL HWROT ('AUTO')
      CALL PHYSOR (2.25,1.)
      CALL AREA2D (5.75,8.)
      CALL HEIGHT (.3)
      CALL MESSAG ('HELICOPTER DESIGN$',-100,0.,8.5)
      CALL RESET ('HEIGHT')
      CALL MESSAG ('AE 4306/4900$',100,1.2,8.25)
      CALL LSTORY (KINDS,4,4.,8.25)
      CALL SWITCH (XANS,1.,X,XORIG,XSTP,XMAX)
      CALL SWITCH (YANS1,2.,Y,YORIG,YSTP,YMAX)
      DO 160 I=1,8
      XTWO(I)=X(I)
160   CONTINUE
      TITALT=4.0
      GO TO 170
170   CONTINUE
C*********************************************************************
C NORMAL DISSPLA CALLS TO ESTABLISH THE STYLE OF WRITING, PUTTING A   *
C BORDER AROUND THE SUBPLOT AREA, MAKING A GENERIC HEADING, SUPPRESSING*
C PRINTED VALUES AT THE ENDS OF THE AXES OF THE GRAPH, CALLING THE    *
C AXES, THEIR INCREMENT AND THEIR VALUES TO BE DRAWN, CALLING THE CURVE*
C THAT PLOTS ONLY A MARKER AND THEN CALLING A ROUTINE THAT LABELS THE *
C MARKERS BY THE TYPE OF AIRCRAFT                                     *
C*********************************************************************
      CALL SETCLR ('RED')
      CALL FRAME
      CALL XAXEND ('NOENDS')
      CALL YAXEND ('NOENDS')
      CALL GRAF (XORIG,XSTP,XMAX,YORIG,YSTP,YMAX)
      CALL RESET ('XTICKS')
      CALL RESET ('YTICKS')
      CALL CURVE (X,Y,8,-1)
      CALL LABEL (X,Y)
      CALL RESET ('HEIGHT')
C*********************************************************************
C SECONDARY AXIS IS DRAWN WITH APPROPRIATE TITLE AND VALUES AND THEN A *
C PLOT OF THE NEW POINTS IS MADE AND THEIR POINTS LABELLED            *
C*********************************************************************
180   CONTINUE
      IF (TITALT.NE.0.0) GO TO 190
      GO TO 350
190   IF (TITALT.NE.1.0) GO TO 200
      CALL SWITCH (XANS2,3.,XTWO,TEMP1,TEMP2,TEMP3)
```

```
      GO TO 230
200   IF (TITALT.NE.2.0) GO TO 210
      CALL SWITCH (YANS2,4.,YTWO,TEMP1,TEMP2,TEMP3)
      GO TO 230
210   IF (TITALT.NE.3.0) GO TO 220
      CALL SWITCH (XANS2,5.,XTWO,TEMP1,TEMP2,TEMP3)
      GO TO 230
220   CONTINUE
      CALL SWITCH (YANS2,6.,YTWO,TEMP1,TEMP2,TEMP3)
      GO TO 230
230   CONTINUE
      CALL SETCLR ('GREEN')
      CALL MARKER (16)
      CALL CURVE (XTWO,YTWO,8,-1)
      CALL LABEL (XTWO,YTWO)
      CALL RESET ('HEIGHT')
      IF (TITALT.NE.1.) GO TO 240
      CALL LEGEND (IPAK,2,0.2,4.5)
      GO TO 270
240   IF (TITALT.NE.2.) GO TO 250
      CALL LEGEND (IPAK,2,0.2,5.5)
      GO TO 270
250   IF (TITALT.NE.3.) GO TO 260
      CALL LEGEND (IPAK,2,0.2,7.)
      GO TO 270
260   IF (TITALT.NE.4.) GO TO 340
      CALL LEGEND (IPAK,2,0.2,7.5)
      GO TO 270
270   CONTINUE
      CALL RESET ('MARKER')
      GO TO 350
C*********************************************************************
C THIS SECTION ALLOWS THE USER TO SELECT 2 SEPARATE GRAPHS ON THE     *
C SAME PAGE ON A HORIZONTAL PAGE FORMAT.                              *
C*********************************************************************
280   IF (ANS.NE.2.) GO TO 340
      WRITE (6,480)
      READ (5,*) ANS
      CALL FRTCMS ('CLRSCRN 6')
      IF (ANS.NE.2.0) GO TO 300
      WRITE (6,600)
      READ (5,*) ANS
      IF (ANS.NE.1.) GO TO 340
      CALL FRTCMS ('CLRSCRN 6')
C
      WRITE (6,410)
      WRITE (6,490)
      READ (5,*) X2ANS(1),Y2ANS(1),X2ANS(2),Y2ANS(2)
```

```
      CALL FRTCMS ('CLRSCRN 6')
      CALL PAGE (11.,8.5)
      CALL AREA2D (9.,6.)
      CALL HEIGHT (.3)
      CALL MESSAG ('HELICOPTER DESIGN$',-100,0.25,6.5)
      CALL RESET ('HEIGHT')
      CALL MESSAG ('AE 4306/4900$',100,1.45,6.25)
      CALL LSTORY (KINDS,4,7.5,6.25)
      CALL ENCGR (0)
      DO 290 I=1,2
      CALL SETCLR ('RED')
      CALL PHYSOR (XPOS(I),YPOS(I))
      CALL AREA2D (3.85,6.)
      CALL FRAME
      CALL HEIGHT (.14)
      CALL SWITCH (X2ANS(I),1.,X,XORIG,XSTP,XMAX)
      CALL SWITCH (Y2ANS(I),2.,Y,YORIG,YSTP,YMAX)
      CALL XAXEND ('NCENDS')
      CALL YAXEND ('NOENDS')
      CALL GRAF (XORIG,XSTP,XMAX,YORIG,YSTP,YMAX)
      CALL RESET ('XTICKS')
      CALL RESET ('YTICKS')
      CALL CURVE (X,Y,8,-1)
      CALL LABEL (X,Y)
      CALL ENCGR (0)
290   CONTINUE
      CALL SETCLR ('BLACK')
      GO TO 350
C***********************************************************************
C THIS SECTION ALLOWS THE USER TO PUT 3 GRAPHS WITH A COMMON X AXIS    *
C ON ONE VERTICAL PAGE PLACED ONE ON TOP OF THE OTHER.                 *
C***********************************************************************
300   IF (ANS.NE.3.0) GO TO 320
      WRITE (6,610)
      READ (5,*) ANS
      IF (ANS.NE.1.) GO TO 340
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,410)
      WRITE (6,500)
      READ (5,*) XANS,Y3ANS(1),Y3ANS(2),Y3ANS(3)
      CALL FRTCMS ('CLRSCRN 6')
      CALL HWROT ('AUTO')
      CALL PAGE (8.5,11.)
      CALL AREA2D (7.,7.)
      CALL HEIGHT (.3)
      CALL MESSAG ('HELICOPTER DESIGN$',-100,0.,8.)
      CALL RESET ('HEIGHT')
      CALL MESSAG ('AE 4306/4900$',100,1.2,7.75)
```

```
      CALL LSTCRY (KINDS,4,5.25,7.75)
      CALL ENDGR (0)
      CALL SETCLR ('GREEN')
      CALL PHYSOR (XPOS(3),YPOS(3))
      CALL AREA2D (7.,2.5)
      CALL FRAME
      CALL SWITCH (XANS,1.,X,XORIG,XSTP,XMAX)
      CALL HEIGHT (.10)
      CALL SWITCH (Y3ANS(1),2.,Y,YORIG,YSTP,YMAX)
      CALL XAXEND ('NOENDS')
      CALL YAXEND ('NOENDS')
      CALL GRAF (XORIG,XSTP,XMAX,YORIG,YSTP,YMAX)
      CALL CURVE (X,Y,8,-1)
      CALL RESET ('HEIGHT')
      CALL LABEL (X,Y)
      CALL ENDGR (0)
      DO 310 I=1,2
      CALL PHYSOR (XPOS(I+3),YPOS(I+3))
      CALL AREA2D (7.,2.5)
      CALL FRAME
      CALL SWITCH (XANS,7.,X,XORIG,XSTP,XMAX)
      CALL HEIGHT (.10)
      CALL SWITCH (Y3ANS(I+1),2.,Y,YORIG,YSTP,YMAX)
      CALL XAXEND ('NOENDS')
      CALL YAXEND ('NOENDS')
      CALL XNONUM
      CALL GRAF (XORIG,XSTP,XMAX,YORIG,YSTP,YMAX)
      CALL RESET ('XTICKS')
      CALL RESET ('YTICKS')
      CALL CURVE (X,Y,8,-1)
      CALL LABEL (X,Y)
      CALL RESET ('HEIGHT')
      CALL ENDGR (0)
310   CONTINUE
      CALL SETCLR ('BLACK')
      GO TO 350
C**********************************************************************
C THIS SECTION ALLOWS THE USER TO PUT 4 GRAPHS ON A HORIZONTAL PAGE,   *
C BASICALLY DIVIDE THE PAGE IN QUARTERS, WITH WHATEVER AXES WANTED.    *
C**********************************************************************
320   CONTINUE
      IF (ANS.NE.4.0) GO TO 340
      WRITE (6,620)
      READ (5,*) ANS
      IF (ANS.NE.1.) GO TO 340
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,410)
      WRITE (6,510)
```

```
      READ (5,*) X4ANS(1),Y4ANS(1),X4ANS(2),Y4ANS(2),X4ANS(3),Y4ANS(3),X
     14ANS(4),Y4ANS(4)
      CALL FRTCMS ('CLRSCRN 6')
      CALL PAGE (11.,8.5)
      CALL AREA2D (9.,5.)
      CALL HEIGHT (.3)
      CALL MESSAG ('HELICOPTER DESIGN$',-100,-.25,5.5)
      CALL RESET ('HEIGHT')
      CALL MESSAG ('AE 4306/4900$',100,.95,5.25)
      CALL LSTORY (KINDS,4,7.5,5.25)
      CALL ENDGR (0)
      DO 330 I=1,4
      CALL PHYSOR (XPOS(I+5),YPOS(I+5))
      CALL SETCLR ('RED')
      CALL AREA2D (4.,2.5)
      CALL FRAME
      CALL HEIGHT (.10)
      CALL SWITCH (X4ANS(I),1.,X,XORIG,XSTP,XMAX)
      CALL SWITCH (Y4ANS(I),2.,Y,YORIG,YSTP,YMAX)
      CALL XAXEND ('NOENDS')
      CALL YAXEND ('NOENDS')
      CALL GRAF (XORIG,XSTP,XMAX,YORIG,YSTP,YMAX)
      CALL RESET ('XTICKS')
      CALL RESET ('YTICKS')
      CALL CURVE (X,Y,8,-1)
      CALL LABEL (X,Y)
      CALL RESET ('HEIGHT')
      CALL ENDGR (0)
330   CONTINUE
      CALL SETCLR ('BLACK')
      GO TO 350
C***********************************************************************
C THIS SECTION ALLOWS THE USER TO REMAIN WITHIN THE PROGRAM IF HE      *
C MAKES A MISTAKE IN ENTERING DATA.                                    *
C***********************************************************************
340   CONTINUE
      WRITE (6,520)
      READ (5,*) ANS
      CALL FRTCMS ('CLRSCRN 6')
      IF (ANS.NE.1.) GO TO 360
      GO TO 30
350   CONTINUE
      CALL ENDPL (0)
C***********************************************************************
C  THIS SECTION IS USED TO ALLOW THE USER TO MAKE ADDITIONAL GRAPHS    *
C  WITHOUT LEAVING THE PROGRAM AND HAVING TO REINITIATE DISSPLA        *
C***********************************************************************
      WRITE (6,530)
```

```
      READ (5,*) ANS
      CALL FRTCMS ('CLRSCRN 6')
      IF (ANS.NE.1.) GO TO 360
      CALL RESET ('ALL')
      GO TO 30
360   CONTINUE
      CALL DONEPL
      STOP
C************************************************************************
370   FORMAT (53H1THIS IS AN INTERACTIVE PROGRAM FOR YOU TO BE ABLE TO,2
     10H GRAPHICALLY DISPLAY,/,36H THE VARIOUS DESIGN PARAMETERS THAT ,3
     29H YOU HAVE BEEN EXPOSED TO IN HELICOPTER,/,15H DESIGN. PLEASE,53H
     3 ENTER A NUMBER AS A RESPONSE TO THE QUESTICNS ASKED.,////,9X,53H*
     4*********  PLEASE FOLLOW THE INSTRUCTIONS **********)
380   FORMAT (//////,18X,38H ENTER A "1" IF YCU DESIRE TO CONTINUE,/,18X
     1,39H_______________________________________)
390   FORMAT (777777,11X,45HPLEASE ENTER THE TYPE OF MACHINE THAT YOU AR
     1E,10H USING NOW,/,10X,57H_____________________________________________
     2____________,///,20X,27H1. TEK 618/3278 COMBINATION,77,20X,11H
     32. TEK 4114,77,20X,25H3. VERSATEC USING DISSPOP)
400   FORMAT (//////6X,47HDO YOU WANT ONE GRAPH OR MULTIPLE GRAPHS ON TH
     1E,11H SAME PAGE:,/,5X,60H_____________________________________________
     2_______________,///,10X,32H1.  ONE GRAPH ONLY WITH MULTIPLE,16
     3H AXES IF DESIRED,7/,10X,19H2.  MULTIPLE GRAPHS)
410   FORMAT (5X,22H1.   MAIN ROTOR RADIUS,13X,9H16.  DISC,8H LOADING,/,
     15X,22H2.   TAIL ROTOR RADIUS,13X,13H17.  FUSELAGE,6H WIDTH,/5X,32H
     23.   NUMBER OF MAIN ROTOR BLADES,3X,11H18.  LENGTH,12H OF FUSELAGE
     3,/,5X,32H4.   NUMBER OF TAIL ROTOR BLADES,3X,5H19.  ,26HHORIZONTAL
     4 FLAT PLATE AREA,/,5X,24H5.   ROTOR SYSTEM HEIGHT,11X,29H20.  VERT
     5ICAL FLAT PLATE AREA,/,5X,19H6.   MAIN ROTOR RPM,16X,21H21.  MAXIM
     6UM VELCCITY,/,5X,19H7.   TAIL ROTOR RPM,16X,5H22.  ,17HMAXIMUM RAN
     7GE(NM),/,5X,27H8.   MAIN ROTOR BLADE CHORD,8X,5H23.  ,13HRATE OF C
     8LIMB,/,5X,27H9.   TAIL ROTOR BLADE CHORD,8X,5H24.  ,17HIGE HOVER C
     9EILING,/,5X,26H10.  MAIN ROTOR BLADE SPAN,9X,5H25.  ,17HOGE HOVER
     $CEILING,/,5X,26H11.  TAIL ROTOR BLADE SPAN,9X,5H26.  ,14HLENGTH OF
     $ TAIL,/,5X,27H12.  MAIN ROTOR BLADE TWIST,8X,5H27.  ,16HOPERATING
     $WEIGHT,/,5X,27H13.  TAIL ROTOR BLADE TWIST,8X,5H28.  ,11HLOAD WEIG
     $HT,/,5X,25H14.  MAIN ROTOR BLADE CDO,10X,5H29.  ,11HFUEL WEIGHT,/,
     $5X,25H15.  TAIL ROTOR BLADE CDO,10X,5H30.  ,16HMAX GROSS WEIGHT/)
420   FORMAT (//4X,44H HOW MANY PARAMETERS DO YOU WANT TO COMPARE?,/,20H
     1       (MAXIMUM OF 3))
430   FORMAT (///8X,45H WHAT TYPE OF GRAPHICAL FORMAT DO YOJ DESIRE:,/,8
     1X,46H______________________________________________,//,47X,3H2. ,1
     24H______________,7,50X,1H1,12X,1H1,7,50X,1H1,12X,1H1,/,12X,3H1. ,2
     30H____________________,15X,1H1,2X,8HVERTICAL,2X,1H1,/,15X,1H1,18X,
     41H1,15X,1H1,1X,10H(8.5 X 11),1X,1H1,/,15X,1H1,4X,10HHORIZONTAL,4X,
     51H1,15X,1H1,12X,1H1,/,15X,1H1,4X,10H(11 X 8.5),4X,1H1,15X,1H1,12X,
     61H1,/,15X,20H1__________________1,15X,14H1____________1)
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```
440    FORMAT (53H ENTER THE X AXIS PARAMETER AND Y AXIS PARAMTER FROM ,1
      14HTHE ABOVE LIST,/,29H (ENTER THEM RESPECTIVELY AND,22H SEPARATED
      2BY A SPACE))
450    FORMAT (///15X,33H WHICH AXIS WILL HAVE TWO SCALES?,/,15X,33H
      1________________________________,//,30X,4H1. X,//,30X,4H2. Y,/,50X,14H
      2______________,/,50X,1HI,12X,1HI,/,50X,1HI,12X,1HI,/,15X,20H
      3____________________,13X,3HY I,2X,8HVERTICAL,2X,1HI,/,15X,1HI,18X,1HI,15
      4X,1HI,1X,10H  FORMAT  ,1X,1HI,/,13X,3HY I,4X,10HHORIZONTAL,4X,1HI,
      515X,1HI,12X,1HI,/,15X,1HI,4X,10H  FORMAT  ,4X,1HI,15X,1HI,12X,1HI,
      6/,15X,20HI__________________I,15X,14HI____________I,/,15X,20H
      7    X           ,15X,14H       X      )
460    FORMAT (47H ENTER THE TWO X AXIS PARAMETERS FIRST AND THEN,21H THE
      1 Y AXIS PARAMETER,/,22H FROM THE LIST ABOVE. ,34H (SEPARATE YOUR E
      2NTRYS BY A SPACE))
470    FORMAT (47H ENTER THE X AXIS PARAMETER FIRST AND THEN THE ,21HTWO
      1Y AXES FARAMETERS,/,22H FROM THE LIST ABOVE. ,34H (SEPARATE YOUR E
      2NTRYS BY A SPACE))
480    FORMAT (//////10X,42H DO YOU WANT 2,3, CR 4 GRAPHS ON ONE PAGE?,/,
      110X,42H__________________________________________,//,25X,12H2.  2
      2GRAPHS,//,25X,12H3.   3 GRAPHS,//,25X,12H4.   4 GRAPHS)
490    FORMAT (50H ENTER THE X AND Y AXIS FOR EACH OF THE TWO GRAPHS,/,48
      1H RESPECTIVELY STARTING WITH THE LEFT GRAPH FIRST,/,34H (SEPARATE
      2YOUR ENTRYS BY A SPACE))
500    FORMAT (49H ENTER THE X AXIS FIRST AND THEN THE THREE Y AXES,/,32H
      1 STARTING FROM THE BOTTOM GRAPH.,/,34H (SEPARATE YOUR ENTRYS BY A
      2SPACE))
510    FORMAT (56H LIST THE PARAMETERS OF YOUR X AND Y AXES FOR EACH GRAP
      1H,10H SEPARATED,/,38H BY SPACES STARTING WITH GRAPH 1 BEING,20H LO
      2WER LEFT, GFAPH 2,/,27H LOWER RIGHT, GRAPH 3 UPPER,17H LEFT AND GR
      3APH 4,/,12H UPPER RIGHT)
520    FORMAT (//////,6X,38H YOU HAVE MADE A MISTAKE---------------,/,12X,
      126H DO YCU WANT TO TRY AGAIN?,/,6X,39H_____________________________
      2__________,//,22X,6H1. YES,/,22X,6H2.  NO)
530    FORMAT (//////18X,35H DO YOU WANT TO MAKE ANOTHER GRAPH?,/,18X,36H
      1____________________________________,///,30X,7H1.  YES,//,30X,6H2.
      2  NO)
540    FORMAT (///6X,42H THIS IS THE TYPE FORMAT THAT YOU SELECTED,16H--I
      1S IT CORRECT?,/,6X,59H____________________________________________
      2_______________,/,30X,6H1.  YES,/,30X,5H2.  NO,///,19X,30H_________
      3_____________________,/,19X,1HI,28X,1HI,/,19X,1HI,28X,1HI,/,17X,3HY
      4 I,28X,1HI,/,19X,1HI,28X,1HI,/,19X,1HI,28X,1HI,/,19X,1HI,28X,1HI,/
      5,19X,30H______________________________,/,33X,1HX)
550    FORMAT (///6X,42H THIS IS THE TYPE FORMAT THAT YOU SELECTED,16H--I
      1S IT CORRECT?,/,6X,59H____________________________________________
      2_______________,/,30X,6H1.  YES,/,30X,5H2.  NO,//,26X,15H__________
      3_____,/,26X,1HI,13X,1HI,/,26X,1HI,13X,1HI,/,26X,1HI,13X,1HI,/,26X,1
      4HI,13X,1HI,/,24X,3HY I,13X,1HI,/,26X,1HI,13X,1HI,/,26X,1HI,13X,1HI
      5,/,26X,1HI,13X,1HI,/,26X,1HI,13X,1HI,/,26X,15H_______________,/,33
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     6X,1HX)
560   FORMAT (///6X,42H THIS IS THE TYPE FORMAT THAT YOU SELECTED,16H--I
     1S IT CORRECT?,/,6X,59H____________________________________________
     2_______________,/,30X,6H1. YES,/,30X,5H2. NO,///,19X,30H__________
     3____________________,/,19X,1HI,28X,1HI,/,19X,1HI,28X,1HI,/,17X,3HY
     4 I,28X,1HI,/,19X,1HI,28X,1HI,/,19X,1HI,28X,1HI,/,19X,1HI,28X,1HI,/
     5,19X,30H______________________________,/,30X,9HPRIMARY X,/,29X,11H
     6SECONDARY X)
570   FORMAT (//6X,42H THIS IS THE TYPE FORMAT THAT YOU SELECTED,16H--IS
     1 IT CORRECT?,/,6X,59H_____________________________________________
     2______________,/,30X,6H1. YES,/,30X,5H2. NO,//,15X,44HS
     3________________________________,/,15X,7HE  P  I,36X,1HI,/,15X,7HC
     4  R  I,36X,1HI,/,15X,7HO  I  I,36X,1HI,/,15X,7HN  M  I,36X,1HI,/,1
     55X,7HD  A  I,36X,1HI,/,15X,7HA  R  I,36X,1HI,/,15X,7HR  Y  I,36X,1
     6HI,/,15X,7HY     I,36X,1HI,/,15X,7H   Y  I,36X,1HI,/,15X,44HY
     7______________________________________,/,38X,1HX)
580   FORMAT (//6X,42H THIS IS THE TYPE FORMAT THAT YOU SELECTED,16H--IS
     1 IT CORRECT?,/,6X,59H_____________________________________________
     2______________,/,30X,6H1. YES,/,30X,5H2. NO,/,26X,15H_____________
     3__,/,26X,1HI,13X,1HI,/,26X,1HI,13X,1HI,/,26X,1HI,13X,1HI,/,24X,3HY
     4 I,13X,1HI,/,26X,1HI,13X,1HI,/,26X,1HI,13X,1HI,/,26X,1HI,13X,1HI,/
     5,26X,1HI,13X,1HI,/,26X,1HI,13X,1HI,/,26X,15H_______________,/,28X,
     69HPRIMARY X,/,27X,11HSECONDARY X)
590   FORMAT (///6X,42H THIS IS THE TYPE FORMAT THAT YOU SELECTED,16H--I
     1S IT CORRECT?,/,6X,59H____________________________________________
     2_______________,/,30X,6H1. YES,/,30X,5H2. NO,//,22X,21HS
     3__________,/,22X,7HE  P  I,13X,1HI,/,22X,7HC  R  I,13X,1HI,/,22X,7
     4HO  I  I,13X,1HI,/,22X,7HN  M  I,13X,1HI,/,22X,7HD  A  I,13X,1HI,/
     5,22X,7HA  R  I,13X,1HI,/,22X,7HR  Y  I,13X,1HI,/,22X,7HY     I,13X
     6,1HI,/,22X,7H   Y  I,13X,1HI,/,22X,21HY      ______________,/,35X,
     71HX)
600   FORMAT (//6X,42H THIS IS THE TYPE FORMAT THAT YOU SELECTED,16H--IS
     1 IT CORRECT?,/,6X,59H_____________________________________________
     2______________,/,30X,6H1. YES,/,30X,5H2. NO,/,19X,34H_____________
     3_____________________,/,19X,1HI,32X,1HI,/,19X,1HI,6X,8H________,6X
     4,8H________,4X,1HI,/,19X,1HI,6X,1HI,6X,1HI,6X,1HI,6X,1HI,4X,1HI,/,
     519X,1HI,6X,1HI,6X,1HI,6X,1HI,6X,1HI,4X,1HI,/,19X,1HI,6X,1HI,6X,1HI
     6,6X,1HI,6X,1HI,4X,1HI,/,19X,1HI,3X,4HY1 I,6X,1HI,3X,4HY2 I,6X,1HI,
     74X,1HI,/,19X,1HI,6X,1HI,6X,1HI,6X,1HI,6X,1HI,4X,1HI,/,19X,1HI,6X,1
     8HI,6X,1HI,6X,1HI,6X,1HI,4X,1HI,/,19X,1HI,6X,8H________,6X,8H______
     9__,4X,1HI,/,19X,1HI,6X,8H   X1   ,6X,8H   X2   ,4X,1HI,/,19X,34H__
     $________________________________)
610   FORMAT (/6X,42H THIS IS THE TYPE FORMAT THAT YOU SELECTED,16H--IS
     1IT CORRECT?,/,6X,59H______________________________________________
     2_____________,/,30X,6H1. YES,/,30X,5H2. NO,/,26X,19H______________
     3_____,/,26X,1HI,17X,1HI,/,26X,1HI,4X,11H___________,2X,1HI,/,26X,6
     4HI Y3 I,9X,1HI,2X,1HI,/,26X,1HI,4X,11H___________,2X,1HI,/,26X,1HI
     5,4X,11H___________,2X,1HI,/,26X,6HI Y2 I,9X,1HI,2X,1HI,/,26X,1HI,4
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     6X,11H___________,2X,1HI,/,26X,1HI,4X,11H___________,2X,1HI,/,26X,6
     7HI  Y1  I,9X,1HI,2X,1HI,/,26X,1HI,4X,11H___________,2X,1HI,/,26X,1HI
     8,9X,1HX,7X,1HI,/,26X,19H___________________)
620   FORMAT (//6X,42H THIS IS THE TYPE FCRMAT THAT YOU SELECTED,16H--IS
     1 IT CORRECT?,/,6X,59H_____________________________________________
     2______________,/,30X,6HI. YES,/,30X,5H2. NO,/,17X,35H_____________
     3______________________,/,17X,1HI,33X,1HI,/,17X,1HI,7X,8H________,5
     4X,8H________,5X,1HI,/,17X,1HI,4X,4HY3 I,6X,1HI,2X,4HY4 I,6X,1HI,5X
     5,1HI,/,17X,1HI,7X,8H________,5X,8H________,5X,1HI,/,17X,1HI,7X,8H
     6  X3   ,5X,8H   X4   ,5X,1HI,/,17X,1HI,7X,8H________,5X,8H________
     7,5X,1HI,/,17X,1HI,4X,4HY1 I,6X,1HI,2X,4HY2 I,6X,1HI,5X,1HI,/,17X,1
     8HI,7X,8H________,5X,8H________,5X,1HI,/,17X,1HI,7X,8H   X1   ,5X,8
     9H   X2   ,5X,1HI,/,17X,35H___________________________________)
      END
C***********************************************************************
C DATA USED THROUGHOUT THE PROGRAM FOR THE COMMON VARIABLES SO THAT    *
C ADDITIONAL FILEDEFS DO NOT HAVE TO BE USED.  DATA OBTAINED HEREIN    *
C IS ONLY THAT OF THE 30 PARAMTERS USED IN COMPARISON                  *
C***********************************************************************
      BLOCK DATA
      REAL R(8),RTR(8),B(8),BTR(8),HT(8),RPM(8),RPMTR(8),C(8),CTR(8)
      REAL RS(8),RSTR(8),TWST(8),TWSTTR(8),CDO(8),CDOTR(8),DL(8)
      REAL WDT(8),LGH(8),FH(8),FV(8),VM(8),RNG(8),RC(8),HOVIGE(8)
      REAL HOVOGE(8),LT(8),OWT(8),LWT(8),FWT(8),MGW(8)
      COMMON /C1/ R,RTR,B,BTR,HT,RPM,RPMTR,C,CTR,RS,RSTR,TWST,TWSTTR,CDO
     1,CDOTR,DL,WDT,LGH,FH,FV,VM,RNG,RC,HOVIGE,HOVOGE,LT,OWT,LWT,FWT,MGW
C***********************************************************************
C THE DATA IS LISTED IN THE FOLLOWING SEQUENTIAL MANNER FOR EASY       *
C MANIPULATION WITHIN THE DISSPLA PROGRAM AND FOR CONSISTENT MARKER    *
C IDENTIFICATION:                                                      *
C                 /AH64,OH6A,SH3H,S76,UH60A,CH54B,CH53D,CH54E/          *
C***********************************************************************
      DATA R/24.,16.3,31.,22.,26.8,36.,36.1,38.5/
      DATA RTR/4.6,4.3,5.3,4.,5.5,8.,8.,10./
      DATA B/4.,4.,5.,4.,4.,6.,6.,7./
      DATA BTR/4.,2.,5.,4.,4.,4.,4.,4./
      DATA HT/12.6,7.,14.3,10.,11.2,17.6,15.8,16./
      DATA RPM/289.,470.,203.,293.,258.,185.,185.,179./
      DATA RPMTR/1403.,3005.,1243.,1609.,1190.,631.,792.,699./
      DATA C/1.75,.57,1.52,1.29,1.75,1.97,2.17,2.44/
      DATA CTR/.83,.40,.61,.54,.81,1.28,1.28,1.28/
      DATA RS/18.8,11.5,29.3,25.0,23.3,29.8,28.9,28.6/
      DATA RSTR/3.1,1.4,4.,3.3,4.25,6.45,6.45,8.53/
      DATA TWST/-9.,-9.,-8.,-10.,-18.,-8.,-6.,-13.6/
      DATA TWSTTR/-8.8,-8.,0.,-8.,-18.,-8.,-8.,-8./
      DATA CDO/.009,.009,.0095,.009,.008,.0095,.0095,.009/
      DATA CDOTR/.009,.009,.0105,.015,.008,.0105,.0095,.0095/
      DATA DL/8.1,4.68,6.96,6.58,8.95,10.3,10.3,15.0/
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      DATA WDT/3.96,4.57,7.08,7.,7.75,7.08,8.83,8.83/
      DATA LGH/49.1,23.0,55.2,43.4,50.1,70.2,67.2,99.0/
      DATA FH/34.7,5.,31.3,11.6,25.7,65.,47.3,63.6/
      DATA FV/45.8,10.8,36.,30.,30.8,99.4,90.,120./
      DATA VM/154.,116.,120.,155.,156.,110.,164.,146./
      DATA RNG/246.,330.,505.,404.,275.,200.,242.,400./
      DATA RC/2490.,500.,500.,425.,200.,189.,625.,325./
      DATA HOVIGE/14200.,7100.,3700.,6200.,7800.,6300.,14000.,6000./
      DATA HOVOGE/11015.,4200.,4000.,2800.,3900.,2400.,8000.,1400./
      DATA LT/29.7,15.2,36.6,26.5,31.5,44.5,44.5,48./
      DATA OWT/11015.,1155.,13600.,5600.,10679.,19234.,23632.,33226./
      DATA LWT/2021.,995.,1759.,2517.,7226.,14186.,14030.,24791./
      DATA FWT/1624.,400.,5641.,1883.,2345.,8580.,4338.,15483./
      DATA MGW/14660.,2550.,21000.,10000.,20250.,42000.,42000.,73500./
      END
C***********************************************************************
C THIS SUBROUTINE TAKES THE X AND Y VALUES FROM THE PARAMTER SELECTION *
C SUBROUTINE(S) AND LABELS THE MARKER POINTS AS TO THE APPRJPRIATE     *
C AIRCRAFT                                                             *
C***********************************************************************
      SUBROUTINE LABEL (X,Y)
      REAL X(8),Y(8)
      CALL HEIGHT (.1)
      CALL MSHIFT (-.1,0.)
      CALL RLMESS ('1$',100,X(1),Y(1))
      CALL MSHIFT (.1,0.)
      CALL RLMESS ('2$',100,X(2),Y(2))
      CALL MSHIFT (0.,-.18)
      CALL RLMESS ('3$',100,X(3),Y(3))
      CALL MSHIFT (0.,.1)
      CALL RLMESS ('4$',100,X(4),Y(4))
      CALL MSHIFT (.1,0.)
      CALL RLMESS ('5$',100,X(5),Y(5))
      CALL MSHIFT (0.,-.18)
      CALL RLMESS ('6$',100,X(6),Y(6))
      CALL MSHIFT (0.,.1)
      CALL RLMESS ('7$',100,X(7),Y(7))
      CALL MSHIFT (.1,0.)
      CALL RLMESS ('8$',100,X(8),Y(8))
      RETURN
      END
C***********************************************************************
C SUBROUTINE USED TO SELECT THE PARAMETER DESIRED FOR THE PRIMARY X    *
C AXIS AND TO RETURN TO THE MAIN PROGRAM THE NECESSARY INFORMATION     *
C SO THAT A PLOT CAN BE MADE                                           *
C***********************************************************************
      SUBROUTINE SWITCH (Z,OPTION,X,XORIG,XSTP,XMAX)
      REAL R(8),RTR(8),B(8),BTR(8),HT(8),RPM(8),RPMTR(8),C(8),CTR(8)
```

```
      REAL RS(8),RSTR(8),TWST(8),TWSTTR(8),CDO(8),CDOTR(8),DL(8)
      REAL WDT(8),LGH(8),FH(8),FV(8),VM(8),RNG(8),RC(8),HOVIGE(8)
      REAL HOVOGE(8),LT(8),OWT(8),LWT(8),FWT(8),MGW(8),X(8)
      REAL XORIG,XSTP,XMAX,Z,OPTION
      INTEGER I
      COMMON /C1/ R,RTR,B,BTR,HT,RPM,RPMTR,C,CTR,RS,RSTR,TWST,TWSTTR,CDO
     1,CDOTR,DL,WDT,LGH,FH,FV,VM,RNG,RC,HOVIGE,HOVOGE,LT,OWT,LWT,FWT,MGW
      CALL XAXEND ('NOENDS')
      CALL YAXEND ('NOENDS')
      CALL YAXANG (0.)
      IF (Z.NE.1.) GO TO 90
      DO 10 I=1,8
      X(I)=R(I)
10    CONTINUE
      XORIG=15.
      XSTP=5.
      XMAX=45.
      IF (OPTION.NE.1.) GO TO 20
      CALL XTICKS (5)
      CALL XNAME ('MAIN ROTOR RADIUS (FT)$',100)
      GO TO 2710
20    IF (OPTION.NE.2.) GO TO 30
      CALL YTICKS (5)
      CALL YNAME ('MAIN ROTOR RADIUS (FT)$',100)
      GO TO 2710
30    IF (OPTION.NE.3.) GO TO 40
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,'MAIN ROTOR RADIUS (FT)$'
     1           ,100,0.,-.75)
      CALL RESET ('XTICKS')
      GO TO 2710
40    IF (OPTION.NE.4.) GO TO 50
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,'MAIN ROTOR RADIUS (FT)$'
     1           ,100,-1.,0.)
      CALL RESET ('YTICKS')
      GO TO 2710
50    IF (OPTION.NE.5.) GO TO 60
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,'MAIN ROTOR RADIUS (FT)$'
     1           ,100,0.,-.75)
      CALL RESET ('XTICKS')
      GO TO 2710
60    IF (OPTION.NE.6.) GO TO 70
      CALL YTICKS (5)
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          CALL YREVTK
          CALL YGRAXS (XORIG,XSTP,XMAX,8.,'MAIN ROTOR RADIUS (FT)$'
         1            ,100,-1.15,0.)
          CALL RESET ('YTICKS')
          GO TO 2710
 70       IF (OPTICN.NE.7.) GO TO 80
          CALL XTICKS (5)
          CALL XNAME (' ',1)
          GO TO 2710
 80       CONTINUE
          GO TO 2700
 90       IF (Z.NE.2.) GO TO 180
          DO 100 I=1,8
          X(I)=RTR(I)
 100      CONTINUE
          XORIG=0.
          XSTP=2.
          XMAX=12.
          IF (OPTION.NE.1.) GO TO 110
          CALL XTICKS (5)
          CALL XNAME ('TAIL ROTOR RADIUS (FT)$',100)
          GO TO 2710
 110      IF (OPTION.NE.2.) GO TO 120
          CALL YTICKS (2)
          CALL YNAME ('TAIL ROTOR RADIUS (FT)$',100)
          GO TO 2710
 120      IF (OPTION.NE.3.) GO TO 130
          CALL XTICKS (2)
          CALL XREVTK
          CALL XGRAXS (XORIG,XSTP,XMAX,9.,'TAIL ROTOR RADIUS (FT)$',
         1             100,0.,-.75)
          GO TO 2710
 130      IF (OPTION.NE.4.) GO TO 140
          CALL YTICKS (2)
          CALL YREVTK
          CALL YGRAXS (XORIG,XSTP,XMAX,6.,'TAIL RCTOR RADIUS (FT)$',
         1             100,-1.,0.)
          GO TO 2710
 140      IF (OPTION.NE.5.) GO TO 150
          CALL XTICKS (2)
          CALL XREVTK
          CALL XGRAXS (XORIG,XSTP,XMAX,6.5,'TAIL ROTOR RADIUS (FT)$',
         1             100,0.,-.75)
          GO TO 2710
 150      IF (OPTION.NE.6.) GO TO 160
          CALL YTICKS (2)
          CALL YREVTK
          CALL YGRAXS (XORIG,XSTP,XMAX,8.,'TAIL ROTOR RADIUS (FT)$',
```

```
     1                100,-1.15,0.)
      GO TO 2710
 160  IF (OPTION.NE.7.) GO TC 170
      CALL XTICKS (2)
      CALL XNAME (' ',1)
      GO TO 2710
 170  CONTINUE
      GO TO 2700
 180  IF (Z.NE.3.) GO TO 270
      DO 190 I=1,8
      X(I)=B(I)
 190  CONTINUE
      XORIG=0.
      XSTP=1.
      XMAX=9.
      IF (OPTION.NE.1.) GO TO 200
      CALL XNAME ('NUMBER MAIN ROTOR BLADES$',100)
      CALL XINTAX
      GO TO 2710
 200  IF (OPTION.NE.2.) GO TO 210
      CALL YNAME ('NUMBER MAIN ROTOR BLADES$',100)
      CALL YINTAX
      GO TO 2710
 210  IF (OPTION.NE.3.) GO TO 220
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1            'NUMBER MAIN ROTOR BLADES$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
 220  IF (OPTION.NE.4.) GO TC 230
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1            'NUMBER MAIN ROTOR BLADES$',100,-1.,0.)
      CALL YINTAX
      GO TO 2710
 230  IF (OPTION.NE.5.) GO TC 240
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1            'NUMBER MAIN ROTOR BLADES$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
 240  IF (OPTION.NE.6.) GO TO 250
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1            'NUMBER MAIN ROTOR BLADES$',100,-1.15,0.)
      CALL YINTAX
      GO TO 2710
 250  IF (OPTION.NE.7.) GO TO 260
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      CALL XNAME (' ',1)
      GO TO 2710
260   CONTINUE
      GO TO 2700
270   IF (Z.NE.4.) GO TO 360
      DO 280 I=1,8
      X(I)=BTR(I)
280   CONTINUE
      XORIG=0.
      XSTP=1.
      XMAX=6.
      IF (OPTION.NE.1.) GO TO 290
      CALL XNAME ('NUMBER TAIL ROTOR  BLADES$',100)
      CALL XINTAX
      GO TO 2710
290   IF (OPTICN.NE.2.) GO TO 300
      CALL YNAME ('NUMBER TAIL ROTOR  BLADES$',100)
      CALL YINTAX
      GO TO 2710
300   IF (OPTION.NE.3.) GO TO 310
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1            'NUMBER TAIL ROTOR BLADES$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
310   IF (OPTION.NE.4.) GO TO 320
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1            'NUMBER TAIL ROTOR BLADES$',100,-1.,0.)
      CALL YINTAX
      GO TO 2710
320   IF (OPTICN.NE.5.) GO TC 330
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1            'NUMBER TAIL ROTOR BLADES$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
330   IF (OPTION.NE.6.) GO TC 340
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1            'NUMBER TAIL ROTOR BLADES$',100,-1.15,0.)
      CALL YINTAX
      GO TO 2710
340   IF (OPTION.NE.7.) GO TO 350
      CALL XNAME (' ',1)
      GO TO 2710
350   CONTINUE
      GO TO 2700
```

```
360     IF (Z.NE.5.) GO TO 450
        DO 370 I=1,8
        X(I)=HT(I)
370     CONTINUE
        XORIG=0.
        XSTP=5.
        XMAX=20.
        IF (OPTION.NE.1.) GO TC 380
        CALL XTICKS (5)
        CALL XNAME ('HEIGHT OF ROTOR SYSTEM (FT)$',100)
        GO TO 2710
380     IF (OPTION.NE.2.) GO TO 390
        CALL YTICKS (5)
        CALL YNAME ('HEIGHT OF ROTOR SYSTEM (FT)$',100)
        GO TO 2710
390     IF (OPTICN.NE.3.) GC TC 400
        CALL XTICKS (5)
        CALL XREVTK
        CALL XGRAXS (XORIG,XSTP,XMAX,9.,
       1             'HEIGHT OF ROTOR  SYSTEM (FT)$',100,0.,-.75)
        GO TO 2710
400     IF (OPTION.NE.4.) GO TO 410
        CALL YTICKS (5)
        CALL YREVTK
        CALL YGRAXS (XORIG,XSTP,XMAX,6.,
       1             'HEIGHT OF ROTOR  SYSTEM (FT)$',100,-1.,0.)
        GO TO 2710
410     IF (OPTION.NE.5.) GO TO 420
        CALL XTICKS (5)
        CALL XREVTK
        CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
       1             'HEIGHT OF ROTOR  SYSTEM (FT)$',100,0.,-.75)
        GO TO 2710
420     IF (OPTICN.NE.6.) GO TC 430
        CALL YTICKS (5)
        CALL YREVTK
        CALL YGRAXS (XORIG,XSTP,XMAX,8.,
       1             'HEIGHT OF ROTOR  SYSTEM (FT)$',100,-1.15,0.)
        GO TO 2710
430     IF (OPTICN.NE.7.) GO TO 440
        CALL XTICKS (5)
        CALL XNAME (' ',1)
        GO TO 2710
440     CONTINUE
        GO TO 2700
450     IF (Z.NE.6.) GO TO 540
        DO 460 I=1,8
        X(I)=RPM(I)
```

```
460   CONTINUE
      XORIG=0.
      XSTP=50.
      XMAX=600.
      CALL XINTAX
      CALL YINTAX
      IF (OPTICN.NE.1.) GO TO 470
      CALL XTICKS (5)
      CALL XNAME ('MAIN ROTOR SPEED (RPM)$',1C0)
      CALL XINTAX
      GO TO 2710
470   IF (OPTICN.NE.2.) GO TO 480
      CALL YTICKS (5)
      CALL YNAME ('MAIN ROTOR SPEED (RPM)$',100)
      CALL YINTAX
      GO TO 2710
480   IF (OPTION.NE.3.) GO TO 490
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1              'MAIN ROTOR SPEED (RPM)$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
490   IF (OPTICN.NE.4.) GO TC 500
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1              'MAIN ROTOR SPEED (RPM)$',100,-1.,0.)
      CALL YINTAX
      GO TO 2710
500   IF (OPTION.NE.5.) GO TO 510
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1              'MAIN ROTOR SPEED (RPM)$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
510   IF (OPTION.NE.6.) GO TC 520
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1              'MAIN ROTOR SPEED (RPM)$',100,-1.15,0.)
      CALL YINTAX
      GO TO 2710
520   IF (OPTION.NE.7.) GO TO 530
      CALL XTICKS (5)
      CALL XNAME (' ',1)
      GO TO 2710
```

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530   CONTINUE
      GO TO 2700
540   IF (Z.NE.7.) GO TO 630
      DO 550 I=1,8
      X(I)=RPMTR(I)
550   CONTINUE
      XORIG=500.
      XSTP=500.
      XMAX=35C0.
      IF (OPTICN.NE.1.) GO TO 560
      CALL XTICKS (5)
      CALL XNAME ('TAIL ROTOR SPEED (RPM)$',100)
      CALL XINTAX
      GO TO 2710
560   IF (OPTION.NE.2.) GO TO 570
      CALL YTICKS (5)
      CALL YNAME ('TAIL ROTOR SPEED (RPM)$',100)
      CALL YINTAX
      GO TO 2710
570   IF (OPTION.NE.3.) GO TC 580
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1            'TAIL ROTOR SPEED (RPM)$',100,C.,-.75)
      CALL XINTAX
      GO TO 2710
580   IF (OPTICN.NE.4.) GO TO 590
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1            'TAIL ROTOR SPEED (RPM)$',100,-1.,0.)
      CALL YINTAX
      GO TO 2710
590   IF (OPTION.NE.5.) GO TC 600
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1            'TAIL ROTOR SPEED (RPM)$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
600   IF (OPTICN.NE.6.) GO TO 610
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1            'TAIL ROTOR SPEED (RPM)$',100,-1.15,0.)
      CALL YINTAX
      GO TO 2710
610   IF (OPTION.NE.7.) GO TO 620
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      CALL XTICKS (5)
      CALL XNAME (' ',1)
      GO TO 2710
620   CONTINLE
      GO TO 2700
630   IF (Z.NE.8.) GO TO 720
      DO 640 I=1,8
      X(I)=C(I)
640   CONTINLE
      XORIG=0.0
      XSTP=0.5
      XMAX=3.C
      IF (OPTION.NE.1.) GO TO 650
      CALL XTICKS (5)
      CALL XNAME ('MAIN ROTOR BLADE CHORD(FT)$',100)
      GO TO 2710
650   IF (OPTICN.NE.2.) GO TC 660
      CALL YTICKS (5)
      CALL YNAME ('MAIN ROTOR BLADE CHORD(FT)$',100)
      GO TO 2710
660   IF (OPTION.NE.3.) GO TO 67C
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1            'MAIN ROTOR BLADE CHORD(FT)$',100,0.,-.75)
      GO TO 2710
670   IF (OPTION.NE.4.) GO TO 680
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1            'MAIN ROTOR BLADE CHORD(FT)$',100,-1.,0.)
      GO TO 2710
680   IF (OPTICN.NE.5.) GO TC 690
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1            'MAIN ROTOR BLADE CHORD(FT)$',100,0.,-.75)
      GO TO 2710
690   IF (OPTION.NE.6.) GO TC 700
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1            'MAIN ROTOR BLADE CHORD(FT)$',100,-1.15,0.)
      GO TO 2710
700   IF (OPTION.NE.7.) GO TO 710
      CALL XTICKS (5)
      CALL XNAME (' ',1)
      GO TO 2710
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710    CONTINUE
       GO TO 2700
720    IF (Z.NE.9.) GO TO 810
       DO 730 I=1,8
       X(I)=CTR(I)
730    CONTINUE
       XORIG=0.3
       XSTP=0.1
       XMAX=1.5
       IF (OPTION.NE.1.) GO TO 74C
       CALL XTICKS (5)
       CALL XNAME ('TAIL ROTOR BLADE CHORD(FT)$',100)
       GO TO 2710
740    IF (OPTION.NE.2.) GO TO 750
       CALL YTICKS (5)
       CALL YNAME ('TAIL ROTOR BLADE CHORD(FT)$',100)
       GO TO 2710
750    IF (OPTION.NE.3.) GO TO 760
       CALL XTICKS (5)
       CALL XREVTK
       CALL XGRAXS (XORIG,XSTP,XMAX,9.,
      1            'TAIL ROTOR BLADE CHORD(FT)$',100,0.,-.75)
       GO TO 2710
760    IF (OPTION.NE.4.) GO TO 770
       CALL YTICKS (5)
       CALL YREVTK
       CALL YGRAXS (XORIG,XSTP,XMAX,6.,
      1            'TAIL ROTOR BLADE CHORD(FT)$',100,-1.,0.)
       GO TO 2710
770    IF (OPTICN.NE.5.) GO TC 780
       CALL XTICKS (5)
       CALL XREVTK
       CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
      1            'TAIL ROTOR BLADE CHORD(FT)$',100,0.,-.75)
       GO TO 2710
780    IF (OPTION.NE.6.) GO TC 790
       CALL YTICKS (5)
       CALL YREVTK
       CALL YGRAXS (XORIG,XSTP,XMAX,8.,
      1            'TAIL ROTOR BLADE CHORD(FT)$',100,-1.15,0.)
       GO TO 2710
790    IF (OPTION.NE.7.) GO TO 800
       CALL XTICKS (5)
       CALL XNAME (' ',1)
       GO TO 2710
800    CONTINUE
       GO TO 2700
810    IF (Z.NE.10.) GO TO 900
```

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      DO 820 I=1,8
      X(I)=RS(I)
820   CONTINUE
      XORIG=10.
      XSTP=5.
      XMAX=40.
      IF (OPTION.NE.1.) GO TO 830
      CALL XTICKS (5)
      CALL XNAME ('MAIN ROTOR BLADE  SPAN(FT)$',100)
      GO TO 2710
830   IF (OPTICN.NE.2.) GC TC 840
      CALL YTICKS (5)
      CALL YNAME ('MAIN ROTOR BLADE  SPAN(FT)$',100)
      GO TO 2710
840   IF (OPTION.NE.3.) GO TO 850
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1            'MAIN ROTOR BLADE  SPAN(FT)$',100,0.,-.75)
      GO TO 2710
850   IF (OPTION.NE.4.) GO TO 860
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1            'MAIN ROTOR BLADE  SPAN(FT)$',100,-1.,0.)
      GO TO 2710
860   IF (OPTION.NE.5.) GC TC 870
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1            'MAIN ROTOR BLADE  SPAN(FT)$',1C0,0.,-.75)
      GO TO 2710
870   IF (OPTION.NE.6.) GO TC 880
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1            'MAIN ROTOR BLADE  SPAN(FT)$',100,-1.15,0.)
      GO TO 2710
880   IF (OPTION.NE.7.) GO TO 890
      CALL XTICKS (5)
      CALL XNAME (' ',1)
      GO TO 2710
890   CONTINUE
      GO TO 2700
900   IF (Z.NE.11.) GO TO 990
      DO 910 I=1,8
      X(I)=RSTR(I)
910   CONTINUE
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```
      XORIG=0.
      XSTP=1.
      XMAX=10.
      IF (OPTION.NE.1.) GO TO 920
      CALL XTICKS (5)
      CALL XNAME ('TAIL ROTOR BLADE SPAN(FT)$',100)
      GO TO 2710
920   IF (OPTICN.NE.2.) GO TC 930
      CALL YTICKS (5)
      CALL YNAME ('TAIL ROTOR BLADE SPAN(FT)$',100)
      GO TO 2710
930   IF (OPTION.NE.3.) GO TO 940
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1            'TAIL ROTOR BLADE SPAN(FT)$',100,0.,-.75)
      GO TO 2710
940   IF (OPTION.NE.4.) GO TO 950
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1            'TAIL ROTOR BLADE SPAN(FT)$',100,-1.,0.)
      GO TO 2710
950   IF (OPTICN.NE.5.) GO TC 960
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1            'TAIL ROTOR BLADE SPAN(FT)$',1C0,0.,-.75)
      GO TO 2710
960   IF (OPTION.NE.6.) GO TC 970
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1            'TAIL ROTOR BLADE SPAN(FT)$',100,-1.15,0.)
      GO TO 2710
970   IF (OPTION.NE.7.) GO TO 980
      CALL XTICKS (5)
      CALL XNAME (' ',1)
      GO TO 2710
980   CONTINUE
      GO TO 2700
990   IF (Z.NE.12.) GO TO 1080
      DO 1000 I=1,8
      X(I)=TWST(I)
1000  CONTINUE
      XORIG=-5.
      XSTP=-5.
      XMAX=-20.
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      IF (OPTION.NE.1.) GO TO 1010
      CALL XTICKS (5)
      CALL XNAME ('MAIN ROTOR BLADE TWIST(DEG)$',100)
      GO TO 2710
1010  IF (OPTION.NE.2.) GO TC 1020
      CALL YTICKS (5)
      CALL YNAME ('MAIN ROTOR BLADE TWIST(DEG)$',100)
      GO TO 2710
1020  IF (OPTICN.NE.3.) GO TO 1030
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1            'MAIN ROTOR BLADE TWIST(DEG)$',100,0.,-.75)
      GO TO 2710
1030  IF (OPTION.NE.4.) GO TC 1040
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1            'MAIN ROTOR BLADE TWIST(DEG)$',100,-1.,0.)
      GO TO 2710
1040  IF (OPTION.NE.5.) GO TG 1050
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1            'MAIN ROTOR BLADE TWIST(DEG)$',100,0.,-.75)
      GO TO 2710
1050  IF (OPTION.NE.6.) GO TO 1060
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1            'MAIN ROTCR BLADE TWIST(DEG)$',100,-1.15,0.)
      GO TO 2710
1060  IF (OPTICN.NE.7.) GO TO 1070
      CALL XTICKS (5)
      CALL XNAME (' ',1)
      GO TO 2710
1070  CONTINLE
      GO TO 2700
1080  IF (Z.NE.13.) GO TO 1170
      DO 1090 I=1,8
      X(I)=TWSTTR(I)
1090  CONTINLE
      XORIG=5.
      XSTP=-5.
      XMAX=-2C.
      IF (OPTION.NE.1.) GO TO 1100
      CALL XTICKS (5)
      CALL XNAME ('TAIL ROTOR BLADE TWIST(DEG)$',100)
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      GO TO 2710
 1100 IF (OPTION.NE.2.) GO TO 1110
      CALL YTICKS (5)
      CALL YNAME ('TAIL ROTOR BLADE TWIST(DEG)$',100)
      GO TO 2710
 1110 IF (OPTION.NE.3.) GO TC 1120
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1            'TAIL ROTOR BLADE TWIST(DEG)$',100,0.,-.75)
      GO TO 2710
 1120 IF (OPTION.NE.4.) GO TO 1130
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1            'TAIL ROTOR BLADE TWIST(DEG)$',100,-1.,0. )
      GO TO 2710
 1130 IF (OPTION.NE.5.) GO TO 1140
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1            'TAIL ROTOR BLADE TWIST(DEG)$',100,0.,-.75)
      GO TO 2710
 1140 IF (OPTICN.NE.6.) GO TO 1150
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1            'TAIL ROTOR BLADE TWIST(DEG)$',100,-1.15,0.)
      GO TO 2710
 1150 IF (OPTION.NE.7.) GO TO 1160
      CALL XTICKS (5)
      CALL XNAME (' ',1)
      GO TO 2710
 1160 CONTINUE
      GO TO 2700
 1170 IF (Z.NE.14.) GO TO 1260
      DO 1180 I=1,8
      X(I)=CCC(I)
 1180 CONTINUE
      XORIG=.007
      XSTP=.001
      XMAX=.011
      IF (OPTICN.NE.1.) GO TO 1190
      CALL XTICKS (5)
      CALL XNAME ('PROFILE DRAG MAIN ROTOR$',100)
      GO TO 2710
 1190 IF (OPTION.NE.2.) GO TC 1200
      CALL YTICKS (5)
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      CALL YNAME ('PROFILE DRAG MAIN ROTCR$',100)
      GO TO 2710
 1200 IF (OPTION.NE.3.) GO TC 1210
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1            'PROFILE DRAG MAIN ROTOR$',100,0.,-.75)
      GO TO 2710
 1210 IF (OPTION.NE.4.) GO TO 1220
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1            'PROFILE DRAG MAIN ROTOR$',100,-1.,0.)
      GO TO 2710
 1220 IF (OPTION.NE.5.) GO TO 1230
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1            'PROFILE DRAG MAIN ROTOR$',100,0.,-.75)
      GO TO 2710
 1230 IF (OPTICN.NE.6.) GO TO 1240
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1            'PROFILE DRAG MAIN ROTCR$',100,-1.15,0.)
      GO TO 2710
 1240 IF (OPTION.NE.7.) GO TC 1250
      CALL XTICKS (5)
      CALL XNAME (' ',1)
      GO TO 2710
 1250 CONTINUE
      GO TO 2700
 1260 IF (Z.NE.15.) GO TO 1350
      DO 1270 I=1,8
      X(I)=CCCTR(I)
 1270 CONTINUE
      XORIG=.007
      XSTP=.C02
      XMAX=.017
      IF (OPTICN.NE.1.) GO TO 1280
      CALL XTICKS (2)
      CALL XNAME ('PROFILE DRAG TAIL ROTOR$',100)
      GO TO 2710
 1280 IF (OPTION.NE.2.) GO TO 1290
      CALL YTICKS (2)
      CALL YNAME ('PROFILE DRAG TAIL ROTCR$',100)
      GO TO 2710
 1290 IF (OPTION.NE.3.) GO TO 1300
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      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1             'PROFILE DRAG TAIL ROTOR$',100,0.,-.75)
      GO TO 2710
 1300 IF (OPTION.NE.4.) GO TC 1310
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1             'PROFILE DRAG TAIL ROTOR$',100,-1.,0.)
      GO TO 2710
 1310 IF (OPTION.NE.5.) GO TO 1320
      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1             'PROFILE DRAG TAIL ROTOR$',100,0.,-.75)
      GO TO 2710
 1320 IF (OPTION.NE.6.) GO TO 1330
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1             'PROFILE DRAG TAIL ROTOR$',100,-1.15,0.)
      GO TO 2710
 1330 IF (OPTION.NE.7.) GC TC 1340
      CALL XTICKS (2)
      CALL XNAME (' ',1)
      GO TO 2710
 1340 CONTINUE
      GO TO 2700
 1350 IF (Z.NE.16.) GO TO 1440
      DO 1360 I=1,8
      X(I)=DL(I)
 1360 CONTINUE
      XORIG=4.
      XSTP=1.
      XMAX=16.
      IF (OPTION.NE.1.) GO TO 1370
      CALL XTICKS (2)
      CALL XNAME ('DISC LOADING$',100)
      GO TO 2710
 1370 IF (OPTION.NE.2.) GO TO 1380
      CALL YTICKS (2)
      CALL YNAME ('DISC LOADING$',100)
      GO TO 2710
 1380 IF (OPTION.NE.3.) GO TO 1390
      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
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     1                'DISC LOADING$',100,0.,-.75)
      GO TO 2710
 1390 IF (OPTION.NE.4.) GO TO 1400
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1                'DISC LOADING$',100,-1.,0.)
      GO TO 2710
 1400 IF (OPTION.NE.5.) GO TO 1410
      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1                'DISC LOADING$',100,0.,-.75)
      GO TO 2710
 1410 IF (OPTICN.NE.6.) GO TO 1420
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1                'DISC LOADING$',100,-1.15,0.)
      GO TO 2710
 1420 IF (OPTICN.NE.7.) GO TC 1430
      CALL XTICKS (2)
      CALL XNAME (' ',1)
      GO TO 2710
 1430 CONTINUE
      GO TO 2700
 1440 IF (Z.NE.17.) GO TO 1530
      DO 1450 I=1,8
      X(I)=WDT(I)
 1450 CONTINUE
      XORIG=2.
      XSTP=1.
      XMAX=10.
      IF (OPTION.NE.1.) GO TO 1460
      CALL XTICKS (2)
      CALL XNAME ('FUSELAGE WIDTH (FT)$',100)
      GO TO 2710
 1460 IF (OPTICN.NE.2.) GO TC 1470
      CALL YTICKS (2)
      CALL YNAME ('FUSELAGE WIDTH (FT)$',100)
      GO TO 2710
 1470 IF (OPTICN.NE.3.) GO TO 1480
      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1                'FUSELAGE WIDTH (FT)$',100,0.,-.75)
      GO TO 2710
 1480 IF (OPTICN.NE.4.) GO TO 1490
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      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1             'FUSELAGE WIDTH (FT)$',100,-1.,0.)
      GO TO 2710
1490  IF (OPTION.NE.5.) GO TO 1500
      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1             'FUSELAGE WIDTH (FT)$',100,0.,-.75)
      GO TO 2710
1500  IF (OPTION.NE.6.) GO TO 1510
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1             'FUSELAGE WIDTH (FT)$',100,-1.15,0.)
      GO TO 2710
1510  IF (OPTION.NE.7.) GO TO 1520
      CALL XTICKS (2)
      CALL XNAME (' ',1)
      GO TO 2710
1520  CONTINUE
      GO TO 2700
1530  IF (Z.NE.18.) GO TO 1620
      DO 1540 I=1,8
      X(I)=LGH(I)
1540  CONTINUE
      XORIG=20.
      XSTP=20.
      XMAX=120.
      IF (OPTION.NE.1.) GO TO 1550
      CALL XTICKS (2)
      CALL XNAME ('FUSELAGE LENGTH (FT)$',100)
      GO TO 2710
1550  IF (OPTION.NE.2.) GO TO 1560
      CALL YTICKS (2)
      CALL YNAME ('FUSELAGE LENGTH (FT)$',100)
      GO TO 2710
1560  IF (OPTION.NE.3.) GO TO 1570
      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1             'FUSELAGE LENGTH (FT)$',100,0.,-.75)
      GO TO 2710
1570  IF (OPTION.NE.4.) GO TO 1580
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
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      1                'FUSELAGE LENGTH (FT)$',100,-1.,0.)
       GO TO 2710
 1580  IF (OPTION.NE.5.) GO TO 1590
       CALL XTICKS (2)
       CALL XREVTK
       CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
      1                'FUSELAGE LENGTH (FT)$',100,0.,-.75)
       GO TO 2710
 1590  IF (OPTICN.NE.6.) GO TO 1600
       CALL YTICKS (2)
       CALL YREVTK
       CALL YGRAXS (XORIG,XSTP,XMAX,8.,
      1                'FUSELAGE LENGTH (FT)$',100,-1.15,0.)
       GO TO 2710
 1600  IF (OPTION.NE.7.) GO TO 1610
       CALL XTICKS (2)
       CALL XNAME (' ',1)
       GO TO 2710
 1610  CONTINUE
       GO TO 27C0
 1620  IF (Z.NE.19.) GO TO 1710
       DO 1630 I=1,8
       X(I)=FH(I)
 1630  CONTINUE
       XORIG=0.
       XSTP=10.
       XMAX=70.
       IF (OPTION.NE.1.) GC TC 1640
       CALL XTICKS (2)
       CALL XNAME ('FRONT FLAT PLATE AREA(SF)$',100)
       GO TO 2710
 1640  IF (OPTION.NE.2.) GO TO 1650
       CALL YTICKS (2)
       CALL YNAME ('FRONT FLAT PLATE AREA(SF)$',100)
       GO TO 2710
 1650  IF (OPTICN.NE.3.) GC TC 1660
       CALL XTICKS (2)
       CALL XREVTK
       CALL XGRAXS (XORIG,XSTP,XMAX,9.,
      1                'FRONT FLAT PLATE AREA(SF)$',100,0.,-.75)
       GO TO 2710
 1660  IF (OPTION.NE.4.) GO TO 1670
       CALL YTICKS (2)
       CALL YREVTK
       CALL YGRAXS (XORIG,XSTP,XMAX,6.,
      1                'FRONT FLAT PLATE AREA(SF)$',100,-1.,0.)
       GO TO 2710
 1670  IF (OPTION.NE.5.) GO TO 1680
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      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1             'FRONT FLAT PLATE AREA(SF)$',100,0.,-.75)
      GO TO 2710
 1680 IF (OPTION.NE.6.) GO TO 1690
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1             'FRONT FLAT PLATE AREA(SF)$',100,-1.15,0.)
      GO TO 2710
 1690 IF (OPTION.NE.7.) GO TO 1700
      CALL XTICKS (2)
      CALL XNAME (' ',1)
      GO TO 2710
 1700 CONTINUE
      GO TO 2700
 1710 IF (Z.NE.20.) GO TO 1800
      DO 1720 I=1,8
      X(I)=FV(I)
 1720 CONTINUE
      XORIG=0.
      XSTP=30.
      XMAX=150.
      IF (OPTION.NE.1.) GO TO 1730
      CALL XTICKS (3)
      CALL XNAME ('VERT. FLAT PLATE AREA(SF)$',100)
      GO TO 2710
 1730 IF (OPTION.NE.2.) GO TO 1740
      CALL YTICKS (3)
      CALL YNAME ('VERT. FLAT PLATE AREA(SF)$',100)
      GO TO 2710
 1740 IF (OPTION.NE.3.) GO TO 1750
      CALL XTICKS (3)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1             'VERT. FLAT PLATE AREA(SF)$',100,0.,-.75)
      GO TO 2710
 1750 IF (OPTION.NE.4.) GO TO 1760
      CALL YTICKS (3)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1             'VERT. FLAT PLATE AREA(SF)$',100,-1.,0.)
      GO TO 2710
 1760 IF (OPTION.NE.5.) GO TO 1770
      CALL XTICKS (3)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
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```
     1                'VERT. FLAT PLATE AREA(SF)$',100,0.,-.75)
      GO TO 2710
1770  IF (OPTICN.NE.6.) GO TC 1780
      CALL YTICKS (3)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1                'VERT. FLAT PLATE AREA(SF)$',100,-1.15,0.)
      GO TO 2710
1780  IF (OPTION.NE.7.) GO TO 1790
      CALL XTICKS (3)
      CALL XNAME (' ',1)
      GO TO 2710
1790  CONTINUE
      GO TO 2700
1800  IF (Z.NE.21.) GO TO 1890
      DO 1810 I=1,8
      X(I)=VM(I)
1810  CONTINUE
      XORIG=100.
      XSTP=10.
      XMAX=180.
      IF (OPTICN.NE.1.) GO TO 1820
      CALL XTICKS (2)
      CALL XNAME ('MAXIMUM VELOCITY (KNT)$',100)
      CALL XINTAX
      GO TO 2710
1820  IF (OPTION.NE.2.) GO TO 1830
      CALL YTICKS (2)
      CALL YNAME ('MAXIMUM VELOCITY (KNT)$',100)
      CALL YINTAX
      GO TO 2710
1830  IF (OPTICN.NE.3.) GO TO 1840
      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1                'MAXIMUM VELOCITY (KNT)$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
1840  IF (OPTICN.NE.4.) GO TC 1850
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1                'MAXIMUM VELOCITY (KNT)$',100,-1.,0.)
      CALL YINTAX
      GO TO 2710
1850  IF (OPTICN.NE.5.) GO TO 1860
      CALL XTICKS (2)
      CALL XREVTK
```

```
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1             'MAXIMUM VELOCITY (KNT)$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
1860  IF (OPTICN.NE.6.) GO TO 1870
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1             'MAXIMUM VELOCITY (KNT)$',100,-1.15,0.)
      CALL YINTAX
      GO TO 2710
1870  IF (OPTION.NE.7.) GO TO 1880
      CALL XTICKS (2)
      CALL XNAME (' ',1)
      GO TO 2710
1880  CONTINUE
      GO TO 450
1890  IF (Z.NE.22.) GO TO 1980
      DO 1900 I=1,8
      X(I)=RNG(I)
1900  CONTINUE
      XORIG=150.
      XSTP=50.
      XMAX=550.
      IF (OPTION.NE.1.) GO TO 1910
      CALL XTICKS (2)
      CALL XNAME ('MAXIMUM RANGES (NM)$',100)
      CALL XINTAX
      GO TO 2710
1910  IF (OPTION.NE.2.) GO TC 1920
      CALL YTICKS (2)
      CALL YNAME ('MAXIMUM RANGES (NM)$',100)
      CALL YINTAX
      GO TO 2710
1920  IF (OPTICN.NE.3.) GO TC 1930
      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1             'MAXIMUM RANGE (NM))
      CALL XINTAX
      GO TO 2710
1930  IF (OPTION.NE.4.) GO TO 1940
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1             'MAXIMUM RANGE (NM))
      CALL YINTAX
      GO TO 2710
```

```
1940  IF (OPTION.NE.5.) GC TO 1950
      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1             'MAXIMUM RANGE (NM))
      CALL XINTAX
      GO TO 2710
1950  IF (OPTICN.NE.6.) GO TC 1960
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1             'MAXIMUM RANGE (NM))
      CALL YINTAX
      GO TO 2710
1960  IF (OPTION.NE.7.) GO TO 1970
      CALL XTICKS (2)
      CALL XNAME (' ',1)
      GO TO 2710
1970  CONTINUE
      GO TO 2700
1980  IF (Z.NE.23.) GO TO 2070
      DO 1990 I=1,8
      X(I)=RC(I)
1990  CONTINUE
      XORIG=C.
      XSTP=500.
      XMAX=3000.
      IF (OPTION.NE.1.) GO TO 2000
      CALL XTICKS (2)
      CALL XNAME ('RATE OF CLIMB (FT/MIN)$',100)
      CALL XINTAX
      GO TO 2710
2000  IF (OPTION.NE.2.) GC TC 2010
      CALL YTICKS (2)
      CALL YNAME ('RATE OF CLIMB (FT/MIN)$',100)
      CALL YINTAX
      GO TO 2710
2010  IF (OPTION.NE.3.) GC TC 2020
      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1             'RATE OF CLIMB (FT/MIN)$',100,C.,-.75)
      CALL XINTAX
      GO TO 2710
2020  IF (OPTICN.NE.4.) GO TO 2030
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
```

```
     1                'RATE OF CLIMB (FT/MIN)$',100,-1.,0.)
      CALL YINTAX
      GO TO 2710
 2030 IF (OPTION.NE.5.) GO TO 2040
      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1                'RATE OF CLIMB (FT/MIN)$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
 2040 IF (OPTION.NE.6.) GO TO 2050
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1                'RATE OF CLIMB (FT/MIN)$',100,-1.15,0.)
      CALL YINTAX
      GO TO 2710
 2050 IF (OPTION.NE.7.) GO TO 2060
      CALL XTICKS (2)
      CALL XNAME (' ',1)
      GO TO 2710
 2060 CONTINUE
      GO TO 2700
 2070 IF (Z.NE.24.) GO TO 2160
      DO 2080 I=1,8
      X(I)=HCVIGE(I)
 2080 CONTINUE
      XORIG=3000.
      XSTP=3000.
      XMAX=15000.
      IF (OPTION.NE.1.) GO TO 2090
      CALL XTICKS (3)
      CALL XNAME ('HOVER CEILING (FT) IGE$',100)
      CALL XINTAX
      GO TO 2710
 2090 IF (OPTION.NE.2.) GO TO 2100
      CALL YTICKS (3)
      CALL YNAME ('HOVER CEILING (FT) IGE$',100)
      CALL YINTAX
      GO TO 2710
 2100 IF (OPTION.NE.3.) GO TO 2110
      CALL XTICKS (3)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1                'HOVER CEILING (FT) IGE$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
 2110 IF (OPTION.NE.4.) GO TO 2120
```

```
      CALL YTICKS (3)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1             'HOVER CEILING (FT) IGE$',100,-1.,0.)
      CALL YINTAX
      GO TO 2710
2120  IF (OPTICN.NE.5.) GO TO 2130
      CALL XTICKS (3)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1             'HOVER CEILING (FT) IGE$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
2130  IF (OPTION.NE.6.) GO TO 2140
      CALL YTICKS (3)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1             'HOVER CEILING (FT) IGE$',100,-1.15,0.)
      CALL YINTAX
      GO TO 2710
2140  IF (OPTICN.NE.7.) GO TO 2150
      CALL XTICKS (3)
      CALL XNAME (' ',1)
      GO TO 2710
2150  CONTINUE
      GO TO 2700
2160  IF (Z.NE.25.) GO TO 2250
      DO 2170 I=1,8
      X(I)=HCVOGE(I)
2170  CONTINUE
      XORIG=0.
      XSTP=3CC0.
      XMAX=18000.
      IF (OPTICN.NE.1.) GO TO 2180
      CALL XTICKS (3)
      CALL XNAME ('HOVER CEILING (FT) OGE$',100)
      CALL XINTAX
      GO TO 2710
2180  IF (OPTION.NE.2.) GO TO 2190
      CALL YTICKS (3)
      CALL YNAME ('HOVER CEILING (FT) OGE$',100)
      CALL YINTAX
      GO TO 2710
2190  IF (OPTION.NE.3.) GO TO 2200
      CALL XTICKS (3)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1             'HOVER CEILING (FT) OGE$',100,0.,-.75)
```

```
      CALL XINTAX
      GO TO 2710
2200  IF (OPTION.NE.4.) GO TO 2210
      CALL YTICKS (3)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1             'HOVER CEILING (FT) OGE$',100,-1.,0.)
      CALL YINTAX
      GO TO 2710
2210  IF (OPTICN.NE.5.) GO TC 2220
      CALL XTICKS (3)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1             'HOVER CEILING (FT) OGE$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
2220  IF (OPTION.NE.6.) GO TO 2230
      CALL YTICKS (3)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1             'HOVER CEILING (FT) OGE$',100,-1.15,0.)
      CALL YINTAX
      GO TO 2710
2230  IF (OPTION.NE.7.) GO TO 2240
      CALL XTICKS (3)
      CALL XNAME (' ',1)
      GO TO 2710
2240  CONTINUE
      GO TO 2700
2250  IF (Z.NE.26.) GO TO 2340
      DO 2260 I=1,8
      X(I)=LT(I)
2260  CONTINUE
      XORIG=10.
      XSTP=10.
      XMAX=60.
      IF (OPTICN.NE.1.) GO TO 2270
      CALL XTICKS (5)
      CALL XNAME ('LENGTH OF TAIL (FT)$',100)
      GO TO 2710
2270  IF (OPTION.NE.2.) GO TO 2280
      CALL YTICKS (5)
      CALL YNAME ('LENGTH OF TAIL (FT)$',100)
      GO TO 2710
2280  IF (OPTICN.NE.3.) GO TC 2290
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
```

```
     1                'LENGTH OF TAIL (FT)$',100,0.,-.75)
      GO TO 2710
2290  IF (OPTION.NE.4.) GO TO 2300
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1                'LENGTH OF TAIL (FT)$',100,-1.,0.)
      GO TO 2710
2300  IF (OPTION.NE.5.) GO TO 2310
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1                'LENGTH OF TAIL (FT)$',100,0.,-.75)
      GO TO 2710
2310  IF (OPTION.NE.6.) GO TO 2320
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1                'LENGTH OF TAIL (FT)$',100,-1.15,0.)
      GO TO 2710
2320  IF (OPTION.NE.7.) GO TO 2330
      CALL XTICKS (5)
      CALL XNAME (' ',1)
      GO TO 2710
2330  CONTINUE
      GO TO 2700
2340  IF (Z.NE.27.) GO TO 2430
      DO 2350 I=1,8
      X(I)=OWT(I)
2350  CONTINUE
      XORIG=0.
      XSTP=5000.
      XMAX=40000.
      IF (OPTION.NE.1.) GO TO 2360
      CALL XTICKS (2)
      CALL XNAME ('OPERATING WEIGHT (LB)$',100)
      CALL XINTAX
      GO TO 2710
2360  IF (OPTION.NE.2.) GO TO 2370
      CALL YTICKS (2)
      CALL YNAME ('OPERATING WEIGHT (LB)$',100)
      CALL YINTAX
      GO TO 2710
2370  IF (OPTION.NE.3.) GO TO 2380
      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1                'OPERATING WEIGHT (LB)$',100,0.,-.75)
```

```
      CALL XINTAX
      GO TO 2710
2380  IF (OPTION.NE.4.) GO TO 2390
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1            'OPERATING WEIGHT (LB)$',100,-1.,0.)
      CALL YINTAX
      GO TO 2710
2390  IF (OPTION.NE.5.) GO TO 2400
      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1            'OPERATING WEIGHT (LB)$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
2400  IF (OPTION.NE.6.) GO TO 2410
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1            'OPERATING WEIGHT (LB)$',100,-1.15,0.)
      CALL YINTAX
      GO TO 2710
2410  IF (OPTION.NE.7.) GO TO 2420
      CALL XTICKS (2)
      CALL XNAME (' ',1)
      GO TO 2710
2420  CONTINUE
      GO TO 2700
2430  IF (Z.NE.28.) GO TO 2520
      DO 2440 I=1,8
      X(I)=LWT(I)
2440  CONTINUE
      XORIG=0.
      XSTP=5000.
      XMAX=30000.
      IF (OPTION.NE.1.) GO TO 2450
      CALL XTICKS (2)
      CALL XNAME ('LOAD WEIGHT (LB)$',100)
      CALL XINTAX
      GO TO 2710
2450  IF (OPTION.NE.2.) GO TO 2460
      CALL YTICKS (2)
      CALL YNAME ('LOAD WEIGHT (LB)$',100)
      CALL YINTAX
      GO TO 2710
2460  IF (OPTION.NE.3.) GO TO 2470
      CALL XTICKS (2)
```

```
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1            'LOAD WEIGHT (LB)$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
 2470 IF (OPTION.NE.4.) GO TO 2480
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1            'LOAD WEIGHT (LB)$',100,-1.,0.)
      CALL YINTAX
      GO TO 2710
 2480 IF (OPTION.NE.5.) GO TO 2490
      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1            'LOAD WEIGHT (LB)$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
 2490 IF (OPTION.NE.6.) GO TO 2500
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1            'LOAD WEIGHT (LB)$',100,-1.15,0.)
      CALL YINTAX
      GO TO 2710
 2500 IF (OPTION.NE.7.) GO TC 2510
      CALL XTICKS (2)
      CALL XNAME (' ',1)
      GO TO 2710
 2510 CONTINUE
      GO TO 27C0
 2520 IF (Z.NE.29.) GO TO 2610
      DO 2530 I=1,8
      X(I)=FWT(I)
 2530 CONTINUE
      XORIG=C.
      XSTP=30C0.
      XMAX=21000.
      IF (OPTION.NE.1.) GO TO 2540
      CALL XTICKS (3)
      CALL XNAME ('FUEL WEIGHT (LB)$',100)
      CALL XINTAX
      GO TO 2710
 2540 IF (OPTION.NE.2.) GO TO 2550
      CALL YTICKS (3)
      CALL YNAME ('FUEL WEIGHT (LB)$',100)
      CALL YINTAX
```

```
      GO TO 2710
 2550 IF (OPTION.NE.3.) GO TO 2560
      CALL XTICKS (3)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1           'FUEL WEIGHT (LB)$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
 2560 IF (OPTION.NE.4.) GO TO 2570
      CALL YTICKS (3)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1           'FUEL WEIGHT (LB)$',100,-1.,0.)
      CALL YINTAX
      GO TO 2710
 2570 IF (OPTION.NE.5.) GO TO 2580
      CALL XTICKS (3)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1           'FUEL WEIGHT (LB)$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
 2580 IF (OPTION.NE.6.) GO TO 2590
      CALL YTICKS (3)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1           'FUEL WEIGHT (LB)$',100,-1.15,0.)
      CALL YINTAX
      GO TO 2710
 2590 IF (OPTION.NE.7.) GO TO 2600
      CALL XTICKS (3)
      CALL XNAME (' ',1)
      GO TO 2710
 2600 CONTINUE
      GO TO 2700
 2610 IF (Z.NE.30.) GO TO 2700
      DO 2620 I=1,8
      X(I)=MGW(I)
 2620 CONTINUE
      XORIG=0.
      XSTP=30000.
      XMAX=90000.
      IF (OPTION.NE.1.) GO TO 2630
      CALL XTICKS (3)
      CALL XNAME ('MAXIMUM GROSS WEIGHT (LB)$',100)
      CALL XINTAX
      GO TO 2710
 2630 IF (OPTION.NE.2.) GO TO 2640
```

```
      CALL YTICKS (3)
      CALL YNAME ('MAXIMUM GROSS WEIGHT (LB)$',100)
      CALL YINTAX
      GO TO 2710
2640  IF (OPTION.NE.3.) GO TC 2650
      CALL XTICKS (3)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1             'MAXIMUM GROSS WEIGHT (LB)$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
2650  IF (OPTION.NE.4.) GO TO 2660
      CALL YTICKS (3)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1             'MAXIMUM GROSS WEIGHT (LB)$',100,-1.,0.)
      CALL YINTAX
      GO TO 2710
2660  IF (OPTION.NE.5.) GO TO 2670
      CALL XTICKS (3)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1             'MAXIMUM GROSS WEIGHT (LB)$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
2670  IF (OPTION.NE.6.) GO TO 2680
      CALL YTICKS (3)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1             'MAXIMUM GROSS WEIGHT (LB)$',100,-1.15,0.)
      CALL YINTAX
      GO TO 2710
2680  IF (OPTION.NE.7.) GO TO 2690
      CALL XTICKS (3)
      CALL XNAME (' ',1)
      GO TO 2710
2690  CONTINUE
      GO TO 2700
2700  CONTINUE
      WRITE (6,2720)
2710  CONTINUE
      CALL RESET ('XREVTK')
      CALL RESET ('YREVTK')
      RETURN
2720  FORMAT (54H YOU HAVE MADE A MISTAKE AND ENTERED AN INVALID NUMBER)
      END
```

# APPENDIX B

## A. USERS GUIDE TO THE CONCEPTUAL DESIGN PROGRAM

The design program has been developed with the user in mind. The program is completely interactive in that it prompts the user for any inputs needed. The following steps should be taken to invoke the program and to get an output file useable for analysis.

1. Logon as normal on either the IBM 3278 or the Tektronix 618 dual screen system

2. Obtain temporary storage space by typing in:

   ```
   DEFINE STORAGE 1M (enter)
   ```

3. When PSW '00020000 00000000' appears on the screen type in:

   ```
   I CMS (enter)
   ```

4. If the program has not been compiled on your disk yet type in the following:

   ```
   FORTGI DESIGN (enter)
   ```

5. After the program has been compiled you are ready to run the program by typing in:

   ```
   DISSPLA (enter)
   ```

6. You will be asked to enter library functions or to press enter. Press the enter key.

7. You will then be asked if you want additional temporary space for shading, etc.. Again, press the enter key.

8. Next you will be asked to enter any defined files that you want. Here you should enter the following:

```
FILEDEF 08 DISK DESIGN (file name)
```

9. After entering the above line the screen will flash and your FILEDEF should be listed on the bottom line of the existing FILEDEFS. If your filedef is listed press the enter key to start the program execution.

10. Follow the instructions given on the screen. You will need the <u>Helicopter Design Manual</u> and the appropriate handouts/references to complete the process.

11. If you are on the IBM 3278 terminal you will not get a graph, therefore, you must plot the total power data by hand and extrapolate the needed data

12. If you are using the TEK 618 dual screen system a graph will be drawn of the total power curve and its components at altitude which can immediately be used to extrapolate the necessary data to complete the entire design process.

13. Note that the output file of all the information that you have computed is in the file that you have defined. To get your data type in:

```
PRINT DESIGN (filename) (CC
```

## B. PROGRAM NOMENCLATURE

| <u>MNEMOMIC</u> | <u>DEFINITION</u> |
|---|---|
| A | Sonic speed at standard sea level |
| AALT | Sonic speed at specification density altitude |
| AASLY | Average aircraft serviceable life in years |
| AFHPF | Average flight hours per flight |
| AFHPY | Average flight hours per year per airframe |
| ALPHA | Ordinate intercept of fuel flow-horsepower curve |
| ALT | Maximum rate of climb calculation altitude |
| ALTSC | Service ceiling altitude |
| AMAX | Steady flow stall angle of the airfoil |

| | |
|---|---|
| ANS | General variable for keyboard answer |
| AR | Aspect ratio of the main rotor system |
| AREAMR | Area of the main rotor disc |
| AREATR | Area of the tail rotor disc |
| ARTR | Aspect ratio of the tail rotor |
| ARVS | Vertical stabilizer aspect ratio |
| AVAIL | Availability of an engine |
| AVAILM | Availability (multiple engine) |
| A11 | Term in definition of THETA2 |
| A12 | Term in definition of THETA2 |
| A13 | Term in definition of THETA2 |
| A14 | Term in definition of THETA2 |
| A80 | Vertical stabilizer angle of attack at 80 knots |
| A90 | Angle of attack of the advancing blade (radians) |
| A160 | Vertical stabilizer angle of attack at 160 knots |
| A90D | Angle of attack of the advancing blade (degrees) |
| A270 | Angle of attack of retreating blade (radians) |
| A270D | Angle of attack of retreating blade (degrees) |
| B | Main rotor tip loss factor |
| BETA | Slope of the fuel flow horsepower curve |
| BH | Main rotor tip loss factor at a hover |
| BL | Blade loading of the main rotor system |
| BLADES | Number of main rotor blades |

| | |
|---|---|
| BLADTR | Number of tail rotor blades |
| BS | Term used in inboard stall analysis |
| BTA | Tail rotor tip loss factor at altitude |
| BTR | Tail rotor tip loss factor |
| BVS | Span of the vertical stabilizer |
| CDO | Coefficient of drag of a main rotor blade |
| CDOTR | Coefficient of drag of a tail rotor blade |
| CHORD | Chord of a main rotor blade |
| CHORDT | Chord of a tail rotor blade |
| CL | Coefficient of lift of a main rotor blade section |
| CLA | Lift curve slope of a main rotor blade section |
| CLMAX | Maximum coefficient of lift for a blade section |
| CL80 | Section coefficient of lift at 80 knots |
| CL160 | Section coefficient of lift at 160 knots |
| COLL | Collective position (radians) |
| COLLD | Collective position (degrees) |
| COMPAR | Weight variance parameter |
| CONST | Constant value in ICAO formulae |
| COUNT | Counter variable |
| CPC | Correction to power coefficient |
| CPS | Correction to power coefficient due to stall |
| CREW | Number of specified crew |
| CS | Term used in stall analysis |

| | |
|---|---|
| CT | Main rotor coefficient of thrust |
| CTH | Main rotor coefficient of thrust at a hover |
| CTTA | Tail rotor coefficient of thrust at altitude |
| CTTR | Tail rotor coefficient of thrust at sea level |
| CYCD | Cyclic position (degrees) |
| CYCLIC | Cyclic position (radians) |
| C1 | Cost of main rotor |
| C2A | Cost of tail rotor |
| C2B | Cost of tail rotor structure |
| C3 | Cost of body |
| C4 | Cost of landing gear |
| C5 | Cost of nacelle |
| C6A | Cost of engine |
| C6B | Cost of drive system |
| C6C | Cost of fuel tanks |
| C7 | Cost of flight controls |
| C8 | Cost of auxillary power |
| C9 | Cost of instruments |
| C10 | Cost of hydraulics |
| C11 | Cost of electrical system |
| C12 | Cost of avionics |
| C13 | Cost of furnishings |
| C14 | Cost of air and ice |

| | |
|---|---|
| C15 | Cost of load and handling |
| D | Diameter of the rotor system |
| DA270 | Blade angle of advancing blade (degrees) |
| DELTA | Fuel flow ratio |
| DERR | Error function |
| DL | Disc loading of the main rotor system |
| DLAMB | Term used in blade stall analysis |
| DP | Parasite drag |
| DREF | Acceptable error function |
| DW | Powerplant dry weight of an engine |
| DWG | Design gross weight |
| DWM | Powerplant dry weight (multiple engine) |
| D1 | Stall analysis parameter |
| D2 | Stall analysis parameter |
| EFPAFF | Effective flat plate area (horizontal) |
| EFPAVF | Effective flat plate area (vertical) |
| EIW | Engine installed weight |
| EIWM | Engine installed weight (multiple engine) |
| ENGSEL | Engine selected |
| ESHPR | Estimated shaft horsepower required to hover |
| EW | Estimated engine weight from weight estimations |
| EWNEW | New engine weight using powerplant data |
| EXCESS | Excess weight |

| | |
|---|---|
| E1 | Stall analysis parameter |
| E2 | Stall analysis parameter |
| E3 | Stall analysis parameter |
| FL | Factor for landing gear weight approximation |
| FSLT | Length of the fuselage |
| FSLTS | Specification maximum length of the fuselage |
| FUEL | Amount of fuel in pounds |
| FW | Fuel weight in pounds |
| FWNEW | Change in original fuel weight for printout |
| GALIN | Internal fuel weight in gallons |
| GALOUT | External fuel weight in gallons |
| GAM | Stall analysis parameter |
| GWSPEC | Specification maximum gross weight |
| HL | Life of the aircraft |
| HOVIGE | Specification hover ceiling (in ground effect) |
| HP | Hover power of the main rotor sysem (out of ground effect) |
| ht | Rotor system height above the ground |
| I | Do loop parameter |
| IC | Initial cost of an engine |
| ICM | Initial costs (multiple engine) |
| IER | Library function error code |
| IF | Installation fraction |
| IHP | Array for plotting |

| | |
|---|---|
| IR | Inflation rate in 1977 dollars |
| K | Do loop parameter |
| KNOTS | Increment for forward speed |
| KNT | Increment for forward speed |
| KNTS | Knots increment for table |
| KS | Stall analysis parameter |
| LAMBDA | Stall analysis parameter |
| LAMB1 | Stall analysis parameter |
| LAMFR | Used for reliability calculation |
| LCC | Life cycle cost of an engine |
| LCCM | Life cycle cost (multiple engine) |
| LERR | Acceptable error function |
| LG | Type of landing gear |
| LOAD | Loading used to find effective flat plate area |
| LREF | Acceptable error function |
| LTR | Length of the tail rotor |
| M | Figure of merit |
| MACH | Maximum allowable Mach number at sea level |
| MACHT | Main rotor system tip Mach number |
| MAINT | Maintainability of an engine |
| MAINTM | Maintainability (multiple engine) |
| MAXRC | Specification rate of climb |
| MAXV | Maxium forward velocity in feet per second |

| | |
|---|---|
| MCRIT | Critical Mach number |
| MCRO | Zero angle of attack critical Mach number |
| MD | Drag divergence Mach number |
| MDT | Mean down time of an engine |
| MTBF | Mean time between engine failures |
| MTBMA | Mean time between maintenance actions per engine |
| MTBR | Mean time between repairs for an engine |
| MTBRM | Mean time between repair (multiple engine) |
| MTIP | Tip Mach number of the main rotor system |
| MTTR | TIP MACH NUMBER OF THE TAIL ROTOR SYSTEM |
| MU | Advance ratio of the main rotor system |
| MUTR | Advance ratio of the tail rotor system |
| N | Do loop parameter |
| NDEG | Order of differential equation |
| NENG | Number of engines |
| NEWUSE | New useful load |
| NN | Do loop parameter |
| NRPL | Number of engine replacements (real or integer) |
| NRPLM | Number of engine replacements (multiple engine) |
| NW | Number of landing gear |
| NXRPL | Number of engine replacements (integer) |
| NXRPLM | Number of engine replacements (multiple engine) |
| OC | Operating cost of an engine |

| | |
|---|---|
| OLD | Previous gross weight used for comparison |
| OMEGA | Main rotor rotational velocity (radians) |
| OMEGTR | Tail rotor rotational velocity (radians) |
| PA | Specification pressure altitude |
| PADJA | Adjusted power at altitude |
| PADJS | Adjusted power at sea level |
| PALT | Rate of climb pressure |
| PAVAIL | Power available |
| PC | Power to climb |
| PCMPA | Array for compressible power at altitude |
| PCMPs | Array for compressible power at sea level |
| PEOPLE | Number of people |
| PI | Induced power of the main rotor system |
| PIE | Constant for value of pi |
| PIHP | Induced power of the main rotor system in HP |
| PITLF | Induced power (IGE) at a forward speed |
| PITLFA | Induced power at altitude at forward speed |
| PITLFS | Induced power at sea level at forward speed |
| PITLGE | Induced power in ground effect |
| PITLGH | Induced power at a hover |
| PITLH | Induced power at a hover |
| PITLTF | Induced power of the tail rotor in forward flight |
| PITLTR | Induced power for the tail rotor |

| | |
|---|---|
| PITRFA | Induced power of the tail rotor at altitude in forward flight |
| PITRFS | Induced power of the tail rotor at sea level in forward flight |
| PIVERT | Induced power vertically |
| PIX | Array used for plotting of total induced power at sea level |
| PIY | Array used for plotting total induced power at altitude |
| PM | Preventative maintenance cost of an engine |
| PMBS | Blade stall power factor |
| PO | Profile power of the main rotor system |
| POC | Profile power to climb |
| POF | Profile power at a forward speed |
| POFA | Profile power at altitude at forward speed |
| POFS | Profile power at sea level at forward speed |
| POH | Profile power at a hover |
| POHP | Profile power of the main rotor system in HP |
| POTA | Profile power of tail rotor at altitude |
| POTR | Profile power for the tail rotor |
| POTRF | Profile power of the tail rotor in forward flight |
| POTRFA | Profile power of the tail rotor at altitude in forward flight |
| POTRFS | Profile power of the tail rotor at sea level in forward flight |
| POX | Array used for plotting of total profile power at sea level |
| POY | Array used for plotting total profile power at altitude |

| | |
|---|---|
| PP | Parasite power |
| PPC | Parasite power to climb |
| PPF | Parasite power at a forward speed |
| PPFA | Parasite power at altitude at forward speed |
| PPFS | Parasite power at sea level at forward speed |
| PPOGE | In ground effect distance parameter |
| PPOGEH | Ground effect factor at a hover |
| PPX | Array used for plotting total parasite power at sea level |
| PPY | Array used for plotting total parasite power at altitude |
| PRESS | Specification pressure altitude |
| PS | Stall power |
| PSHP | Phantom shaft horsepower |
| PT | Total power of the main rotor system |
| PTACH | Total power for the aircraft to hover |
| PTAH | Total power of the aircraft to hover |
| PTAVAL | Total power available |
| PTF | Total power at a forward velocity |
| PTFA | Total power at altitude at forward speed |
| PTFS | Total power at sea level at forward speed |
| PTH | Total power at a hover |
| PTHOVS | Total power to hover |
| PTHP | Total power of the main rotor system in HP |
| PTTAHP | Total power of the aircraft to hover in HP |

| | |
|---|---|
| PTTRF | Total power of the tail rotor in forward flight |
| PTTRFA | Total power of the tail rotor at altitude in forward flight |
| PTTRFS | Total power of the tail rotor at sea level in forward flight |
| PTTRH | Total power for the tail rotor at a hover |
| PTTRHP | Total power for the tail rotor at a hover in HP |
| PTVERT | Total power vertically |
| PTX | Array used for plotting total power at sea level |
| PTY | Array used for plotting total power at altitude |
| Q | Production run quantity |
| R | Rotor radius |
| RBS | Retreating blade stall velocity |
| RC | Recovery cost of an engine |
| RCLIMB | Rate of climb |
| RCM | Recovery cost (multiple engine) |
| RDC | Research and development cost of an engine |
| RDCM | Research and development costs (multiple engine) |
| RELY | Reliability of an engine |
| RELYM | Reliability (multiple engine) |
| REVWE | Revised empty weight |
| REVWG | Revised gross weight |
| RHOALT | Density at specification density altitude |
| RHOMH | Density at hover in ground effect ceiling |
| RHOS | Density at service ceiling |

| | |
|---|---|
| RHOSC | Service ceiling density |
| RHOSL | Sea level density |
| RNGMAX | Maximum range as per specification |
| RNGNMX | New maximum range |
| RSHPC | Required shaft horsepower for cruise |
| RSHPME | Required shaft horsepower for max endurance speed |
| RSHRME | Total required shaft horsepower for max enduracne |
| RSHPRC | Total required shaft horsepower for cruise |
| RRSHP | Required shaft horsepower |
| RSHPM | Required shaft horsepower (military) |
| RSPEC | Specification maximum rotor radius |
| RT | Stall analysis parameter |
| RTR | Tail rotor radius |
| S | Main rotor planform area for weight estimation |
| SB | Body surface area for weight estimation |
| SC | Specification service ceiling |
| SFCC | Cruise specific fuel consumption |
| SFCM | Military specific fuel consumption |
| SFCN | Normal specific fuel consumption |
| SHPC | Cruise shaft horsepower |
| SHPM | Military shaft horsepower |
| SHPMM | Military shaft horsepower (multiple engine) |
| SHPN | Normal shaft horsepower |

| | |
|---|---|
| SIG | Pressure ratio |
| SIGMA | Solidity of the main rotor system |
| SIGTR | Solidity of the tail rotor system |
| SIM | Weight variance parameter |
| SPCLOD | Specification useful load |
| STEP | Variance parameter for iterations |
| STT | Total tail surface area for weight estimation |
| SV | Salvage value |
| SVM | Salvage value (multiple engine) |
| TALT | Rate of climb temperature |
| TEMP | Specification temperature |
| THETA | Temperature ratio |
| THETA0 | Collective angle in radians |
| THETA2 | Cyclic angle in radians |
| TOTALC | Total cost of an aircraft in a production run |
| TRIP1 | Trips the program so that repetitive questions are repeated |
| TRIP2 | Trips the program so that repetitive questions are repeated |
| TRIP3 | Trips the program so that repetitive questions are repeated |
| TRIP4 | Trips the program so that repetitive questions are repeated |
| TRIP5 | Trips the program so that repetitive questions are repeated |
| TSHP | Total shaft horsepower |
| TTR | Thrust of the tail rotor |

| | |
|---|---|
| TTR80 | Tail rotor thrust at 80 knots |
| TTR160 | Tail rotor thrust at 160 knots |
| TWIST | Twist of main rotor blade |
| TYPE | Type of helicopter (light,medium,heavy) |
| TYPEM | Type of aircraft (light,medium,heavy) |
| T1 | Term used in defining THETA0 |
| T2 | Term used in defining THETA0 |
| T3 | Term used in defining THETA0 |
| T4 | Term used in defining THETA0 |
| USELOD | Useful load desired |
| VCR | Cruise velocity as per specification |
| VELMAX | Maximum forward velocity |
| VF | Forward velocity |
| VFWD | Forward velocity |
| VF80 | Forward velocity at 80 knots in ft/sec |
| VF160 | Forward velocity at 160 knots in ft/sce |
| VI | Induced velocity in a hover |
| VINEW | Induced velocity at hover |
| VIT | Vertical induced velocity at a hover |
| VITNEW | Induced vertical velocity at a hover |
| VITR | Induced velocity of the tail rotor |
| VITTR | Induced vertical velocity of the tail rotor |
| VL | stall parameter |

| | |
|---|---|
| VMAX | Specification maximum forward velocity |
| VMAXE | Maximum endurance velocity |
| VMAXF | Maximum forward velocity in knots |
| VMAXK | Initial forward velocity for stall analysis |
| VMAXR | Maximum range velocity |
| VOPT | Optimum velocity for aircraft in ft/sec |
| VOPTK | Optimum velocity for aircraft in knots |
| VS | Forward speed in ft/sec |
| VSK | Forward speed in knots |
| VTIP | Tip velocity of the main rotor system |
| VTIPTR | Tail rotor tip velocity |
| VTNEW | Solution to fourth order differential equation |
| VVERT | Vertical velocity |
| WE | Manufacturers empty weight |
| WFC | Cruise fuel flow rate |
| WFCR | Fuel flow rate for cruise flight |
| WFM | Military fuel flow rate |
| WFME | Fuel flow rate for max endurance velocity |
| WFN | Normal fuel flow rate |
| WG | Gross weight |
| WGNEW | New gross weight |
| WXO | Transmission and oil weight |
| WXOM | Transmission and oil weight (multiple engine) |

| | |
|---|---|
| W1 | Rotor weight |
| W2A | Tail rotor weight |
| W2B | Tail rotor structure weight |
| W3 | Body weight |
| W4 | Landing gear weight |
| W5 | Nacelle weight |
| W6A | Engine weight |
| W6B | Drive weight |
| W6C | Fuel tank weight |
| W7 | Flight control weight |
| W8 | Auxillary power weight |
| W9 | Instrument weight |
| W10 | Hydraulic weight |
| W11 | Electrical weight |
| W12 | Avionics weight |
| W13 | Furnishings weight |
| W14 | Air and ice weight |
| W15 | Load and handling weight |
| XO | Radius used for stall analysis (inboard) |
| XRLG | Fixed or retractable landing gear |
| XS | Radius outboard analysis |
| YMC | Yearly maintenance cost of an engine |
| YMCM | Yearly maintenance costs (multiple engine) |

| | |
|---|---|
| YOC | Yearly operating cost of an engine |
| YOCM | Yearly operating costs (multiple engine) |
| ZCMPLX | Array for library function |
| ZHI | Zero horsepower intercept |

## C. PROGRAM LISTING

```
 REAL TRIP1,TRIP2,TRIP3,TRIP4,SC,HOVIGE,RSPEC,FSLTS,MAXRC,SPCLOD,TR
1IP5,COUNT/0./,IR
 REAL WG,GWSPEC
 REAL WE
 REAL A,MACH,VMAX,PIE,RHOSL
 REAL DL,R,AREAMR
 REAL OMEGA
 REAL VTIP,CT
 REAL VMAXF,MAXV,MU,BL,SIGMA
 REAL CHORD,AR
 REAL CL
 REAL CLA,CDC
 REAL B,PI,PC,PT,PIHP,POHP,PTHP,HP
 REAL FUEL,USELOD,STT,SB,S,W1,W2A,W2B,W3,W4,W5,W6A,W6B,W6C,W7,W8,W9
1,W10,W11,W12,W13,W14,W15,REVWE,REVWG,TYPE
 REAL M,ANS,CLD/0./
 REAL STEP,FL,LG,XRLG,NW
 REAL H,C,PPOGE,PITLGE,PTHOVS
 REAL LCAC,EFPAFF,KNTS
 REAL VF,PPF,POF,VI,VIT,PITLF,PTF,MACHT,PPFS(55),POFS(55),PITLFS(55
1),PTFS(55),AALT,RHOALT,PPFA(55),POFA(55),PITLFA(55),PTFA(55),TEMP,
2THETA,PRESS,SIG,PA,CONST
 REAL RTR,OMEGTR,CDOTR,LTR,ARTR,CHORDT,SIGTR
 REAL AREATR,TTR,VTIPTR,CTTR,BTR,PITLTR,POTR,PTTRH,PTTRHP,CTTA,BTA,
1PITLTA,POTA,PTTAH,PTTAHP
 REAL MUTR,PCTRF,POTRFS(55),PITRFS(55),PTTRFS(55),MTTR,POTRFA(55),P
1ITRFA(55),PTTRFA(55),VITR,VITTR,PTTRF,PITLTF
 REAL TTR160,TTR80,VS,BVS,CL80,CL160,VF80,VF160,CLARVS,A80,A160,ARV
1S
 REAL LAMBDA,KS,MCRIT,MTIP,LERR,MCRO,LAMBD1,CLMAX,VL,VMAXK,PCMPA(55
1),PCMPS(55),C1,C2,T1,T2,T3,T4,A11,A12,A13,A14,DP,DLAMB,LREF,E1,E2,
2E3,D1,D2,CYCLIC,COLL,TWIST,GAM,AMAX,BS,RT,XS,XO,CS,CPS,KS,PS,A90,A
3270,A90D,A270D,MD,CPC,TSHP,VOPT,VOPTK,VSK,THETA0,THETA2,DA270,DREF
4,DERR,PMBS,CYCD,COLLD
 REAL PTAH,PCX(55),PIX(55),PPX(55),PTX(55),POY(55),PIY(55),PPY(55),
1PTY(55),KNOTS(55)
 REAL PADJS,PADJA,RRSHP
 REAL RHCS,CTH,BH,PITLH,PPOGEH,POH,PTH,RSHPM,PTACH,PITLGH
 REAL ESHPR
 REAL AFHPY,AFHPF,AASLY,HL,PM(6),OC(6),YMC(6),YOC(6),MTBR(6),NRPL(6
1),NXRPL(6),EIW(6),RC(6),DW(6),IF(6),IC(6),SV(6),WXO(6),SHPM(6),LAM
2FR(6),MTBF(6),RELY(6),AVAIL(6),MTBMA(6),MDT(6),LCC(6),RDC(6),MAINT
3(6),DWM(6),ICM(6),SHPMM(6),RDCM(6),MTBRM(6),YMCM(6),YOCM(6),NRPLM(
46),NXRPLM(6),EIWM(6),RCM(6),SVM(6),WXOM(6),RELYM(6),AVAILM(6),LCCM
5(6),MAINTM(6),SHPC(6),SHPN(6),ENGSEL
```

```
      REAL EW,EWNEW,WGNEW,COMPAR
      REAL WFM,WFC,WFN,SFCN(6),SFCM(6),SFCC(6)
      REAL BETA,ALPHA
      REAL DELTA,ZHI
      REAL PSHP,TYPEM,FSLT
      REAL VMAXR
      REAL VMAXE,RSHPME,RSHRME,WFME
      REAL RSHPC,RSHPRC,WFCR,RNGMAX,VCR
      REAL FW,GALIN,GALOUT,EXCESS
      REAL DWG,RNGNMX,NEWUSE,SIM
      REAL VVERT,EFPAVF,PC,VFWD,PPC,POC,PIVERT,VINEW,PAVAIL,PTAVAL,PTVER
     1T,VITNEW(5),VTNEW,RCLIMB
      REAL ALT,PALT,TALT,RHOMH
      REAL ALTSC,RHOSC
      REAL TOTALC,Q,C1,C2A,C2B,C3,C4,C5,C6A,C6B,C6C,C7,C8,C9,C10,C11,C12
     1,C13,C14,C15
      REAL PP,KNT,RBS,FWNEW,VELMAX
      INTEGER I,BLADES,NENG,PEOPLE,BLADTR,IHP(600),CREW,N,NN,NDEG,IER/0/
     1,K
      COMPLEX ZCMFLX(4)
      DATA DW/158.,288.,423.,709.,580.,750./
      DATA SHFM/420.,708.,1561.,1800.,2500.,3400./
      DATA SHPN/370.,659.,1318.,1530.,2200.,3000./
      DATA SHPC/278.,494.,989.,1148.,1650.,2250./
      DATA SFCM/.650,.573,.460,.595,.615,.543/
      DATA SFCN/.651,.573,.470,.606,.622,.562/
      DATA SFCC/.709,.599,.510,.661,.678,.610/
      DATA IC/93.,100.,580.,360.,640.,700./
      DATA OC/.008,.016,.020,.035,.040,.060/
      DATA PM/.025,.050,.100,.125,.160,.220/
      DATA MTBMA/3.5,3.0,2.0,3.0,4.0,3.5/
      DATA MDT/.7,.6,.5,1.3,2.,2.6/
      DATA MTBF/185.,210.,205.,285.,280.,320./
      DATA MTBR/600.,750.,800.,800.,1000.,750./
      DATA RCC/0.,0.,0.,0.,0.,0./
      DATA IF/.29,.29,.27,.24,.27,.24/
      DATA DERR/.001/,LERR/.0001/
C*********************************************************************
      WRITE (6,1560)
      READ (5,*) ANS
      CALL FRTCMS ('CLRSCRN 6')
      IF (ANS.NE.1.) GO TO 10
      CALL TEK618
      GO TO 20
10    CONTINUE
      TRIP5=5.
20    CONTINUE
      TRIP1=0.
```

```
      TRIP2=0.
      TRIP3=0.
      TRIP4=0.
      WRITE (6,2660)
      READ (5,*) CREW
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,2750)
      READ (5,*) SPCLOD
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,2680)
      READ (5,*) FOVIGE
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,2670)
      READ (5,*) SC
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,1620)
      READ (5,*) VMAXF
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,2370)
      READ (5,*) VCR
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,2360)
      READ (5,*) RNGMAX
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,2720)
      READ (5,*) MAXRC
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,1570)
      READ (5,*) GWSPEC
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,2690)
      READ (5,*) FSPEC
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,2700)
      READ (5,*) FSLTS
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,2050)
      READ (5,*) AFHPY
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,2060)
      READ (5,*) AFHPF
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,2070)
      READ (5,*) AASLY
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,2640)
      READ (5,*) PA
      CALL FRTCMS ('CLRSCRN 6')
```

```
      WRITE (6,2650)
      READ (5,*) TEMP
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,2820)
      READ (5,*) IR
      CALL FRTCMS ('CLRSCRN 6')
C***********************************************************************
C      2.1 MAKE A ROUGH ESTIMATE OF GROSS WEIGHT                       *
C***********************************************************************
      WRITE (6,1590)
      READ (5,*) WG
      CALL FRTCMS ('CLRSCRN 6')
      WG=0.8*WG
      WRITE (6,1600) WG
C***********************************************************************
C      2.2 MAKE A ROUGH ESTIMATE OF THE MANUFACTURER'S EMPTY           *
C         WEIGHT                                                       *
C***********************************************************************
      WRITE (6,1580)
      READ (5,*) WE
      CALL FRTCMS ('CLRSCRN 6')
C***********************************************************************
C      2.3 CALCULATE THE MAXIMUM TIP VELOCITY                          *
C***********************************************************************
      A=1116.89
      MACH=0.65
      VMAX=MACH*A
      PIE=3.1415927
      RHOSL=.0023769
C***********************************************************************
C      2.4 DETERMINE THE ROTOR RADIUS                                  *
C***********************************************************************
      WRITE (6,1610) WG
      READ (5,*) DL
      CALL FRTCMS ('CLRSCRN 6')
30    R=SQRT(WG/(PIE*DL))
      AREAMR=PIE*R**2
C***********************************************************************
C      2.5 DETERMINE A FIRST-CUT ROTATIONAL VELOCITY                   *
C***********************************************************************
      OMEGA=VMAX/R
C***********************************************************************
C      2.6 MAKE A FIRST-CUT DETERMINATION OF THRUST                    *
C         COEFFICIENT                                                  *
C***********************************************************************
40    CONTINUE
      VTIP=OMEGA*R
      CT=WG/(AREAMR*RHOSL*VTIP**2)
```

```
C**********************************************************************
C     2.7 DETERMINE THE BLADE SOLIDITY                                 *
C**********************************************************************
      IF (TRIP1.EQ.1.) GO TO 50
      MAXV=VMAXF
      VMAXF=VMAXF*1.151*5280.0/3600.0
50    CONTINUE
      MU=VMAXF/VTIP
      WRITE (6,1630) MU
      WRITE (6,1640)
      READ (5,*) BL
      CALL FRTCMS ('CLRSCRN 6')
      SIGMA=CT/BL
C**********************************************************************
C     2.8 DETERMINE THE NUMBER OF MAIN ROTOR BLADES                    *
C**********************************************************************
      IF (TRIP1.EQ.1.) GO TO 60
      WRITE (6,1650)
      READ (5,*) BLADES
      CALL FRTCMS ('CLRSCRN 6')
60    CONTINUE
C**********************************************************************
C     2.9 DETERMINE THE CHORD AND THE ASPECT RATIO                     *
C**********************************************************************
      CHORD=SIGMA*PIE*R/FLOAT(BLADES)
70    AR=R/CHORD
      IF (AR.GT.20.) GO TO 80
      IF (AR.LT.15.) GO TO 80
      GO TO 90
80    CONTINUE
      WRITE (6,1660) WG,WE,A,VMAX,DL,R,OMEGA,VTIP,CT,MU,BL,SIGMA,BLADES,
     1CHORD
      WRITE (8,1660) WG,WE,A,VMAX,DL,R,OMEGA,VTIP,CT,MU,BL,SIGMA,BLADES,
     1CHORD
      WRITE (6,1670) AR,OMEGA
      WRITE (8,1670) AR,OMEGA
      WRITE (6,1680)
      READ (5,*) OMEGA
      CALL FRTCMS ('CLRSCRN 6')
      TRIP1=1.
      GO TO 40
90    CONTINUE
C**********************************************************************
C     2.10 DETERMINE THE AVERAGE LIFT COEFFICIENT                      *
C**********************************************************************
      CL=(6.*CT)/SIGMA
C**********************************************************************
C     2.11 CHOOSE AN AIRFOIL SECTION FOR THE MAIN ROTOR BLADES         *
```

```
C                                                                      *
C      2.12 DETERMINE AVERAGE LIFT CURVE SLOPE AND AVERAGE PROFILE     *
C           DRAG COEFFICIENT                                           *
C***********************************************************************
       IF (TRIP2.EQ.2.) GO TO 100
       WRITE (6,1690)
       READ (5,*) CLA
       CLA=CLA*180./PIE
       CALL FRTCMS ('CLRSCRN 6')
100    CONTINUE
       IF (TRIP2.EQ.2.) GO TO 110
       WRITE (6,1700)
       READ (5,*) CDO
       CALL FRTCMS ('CLRSCRN 6')
110    CONTINUE
       WRITE (6,1710) WG,WE,A,VMAX,DL,R,OMEGA,VTIP,CT,MU,BL,SIGMA,BLADES,
      1CHORD,AR,CL,CLA,CDO
       WRITE (8,1710) WG,WE,A,VMAX,DL,R,OMEGA,VTIP,CT,MU,BL,SIGMA,BLADES,
      1CHORD,AR,CL,CLA,CDO
120    CONTINUE
C***********************************************************************
C      3.1 MAKE FIRST ESTIMATE OF THE POWER REQUIRED TO HOVER (OPE) SSL *
C***********************************************************************
       B=1.-SQRT(2.*CT)/FLOAT(BLADES)
       PI=(1./B)*(WG**1.5/SQRT(2.*RHOSL*AREAMR))
       PO=.125*SIGMA*CDO*RHOSL*AREAMR*VTIP**3
       PT=PI+PO
       PIHP=PI/550.
       POHP=PO/550.
       PTHP=PT/550.
       HP=PT/550.
C***********************************************************************
C      3.2 MAKE SECOND GROSS WEIGHT ESTIMATE                           *
C***********************************************************************
       IF (TRIP2.EQ.2.) GO TO 130
       WRITE (6,1720)
       READ (5,*) FUEL
       CALL FRTCMS ('CLRSCRN 6')
       WRITE (6,1730)
       READ (5,*) USELOD
       CALL FRTCMS ('CLRSCRN 6')
       WRITE (6,1740)
       READ (5,*) PEOPLE
       CALL FRTCMS ('CLRSCRN 6')
       WRITE (6,1750)
       READ (5,*) NENG
       CALL FRTCMS ('CLRSCRN 6')
       WRITE (6,2710)
```

```
      READ (5,*) TYPE
      CALL FRTCMS ('CLRSCRN 6')
130   CONTINUE
      IF (TYPE.NE.1.) GO TO 160
      IF (TRIP2.EQ.2.) GO TO 140
      WG=173.701*WE**.378
140   CONTINUE
      STT=.264*EXP(.0135*HP)
      SB=194.274*ALOG(WG)-1306.779
      S=CHORD*(FLOAT(BLADES))*R
      W1=408.562*ALOG(S)-1142.917
      W2A=2.219*EXP(.0005*WG)
      W2B=19.131*ALOG(STT)-32.414
      W3=.00901*SB**1.917
      IF (COUNT.NE.0.) GO TO 150
      W4=-.0539*WG+200.912
150   CONTINUE
      W5=34.
      W6A=-.0896*HP+221.338*FLOAT(NENG)
      W6B=17.190*EXP(.0008*WG)
      W6C=.384*(FUEL/6.5)**1.0717
      W7=(1.28E-10)*WG**3.469
      W8=0.
      W9=24.571*EXP(.0004*HP)
      W10=0.0
      W11=-51.0661*ALOG(SB)+367.947
      W12=1062.00451-122.282*ALOG(1120.354*EXP(.003*HP))
      W13=19.800*(EXP(.372*FLOAT(PEOPLE))+EXP(-.033*SB))
      W14=-22.371*ALOG(SB)+143.396
      W15=0.0
      GO TO 270
160   IF (TYPE.NE.2.) GO TO 240
      IF (TRIP2.EQ.2.) GO TO 170
      WG=16239.43*ALOG(WE)-130252.76
170   CONTINUE
      STT=.0376*HP-8.106
      SB=636.081*EXP(.000011*WG)
      S=CHORD*(FLOAT(BLADES))*R
      W1=11.0702*S-168.888
      W2A=.00438*WG+12.470
      W2B=2.411*STT-19.531
      W3=.282*SB**1.272
      IF (COUNT.NE.0.) GO TO 190
      IF (WG.GT.6000.) GO TO 180
      W4=.025*EXP(.000062*WG+8.020)
      GO TO 190
180   W4=301.577*ALOG(WG)-2319.890
190   CONTINUE
```

```
      W5=.02*EXP(.000062*WG+8.02)
      IF (NENG.NE.1.) GO TO 200
      W6A=130.0+.451*HP
      GO TO 210
200   W6A=(295.0+.188*HP)*FLOAT(NENG)
210   W6B=(741.460*ALOG(HP)-4542.0420)
      W6C=(363.24*ALOG(FUEL/6.5)-1656.521)
      W7=210.858*EXP(.000059*WG)
      IF (NENG.NE.1.) GO TO 220
      W8=0.0
      GO TO 230
220   W8=190.0
230   W9=56.0975*ALOG(HP)-312.237
      W10=.00362*WG+11.553
      W11=481.735*ALOG(SB)-2794.53
      W12=.139*HP+77.823
      W13=.175*SB+22.*FLOAT(PEOPLE)-10.
      W14=122.468*ALOG(SB)-730.252
      W15=84.5
      GO TO 270
240   CONTINUE
      IF (TRIP2.EQ.2.) GO TO 250
      WG=4.975*WE**.887
250   CONTINUE
      STT=60.127*EXP(.000145*HP)
      SB=426.378*EXP(.000045*WG)
      S=CHORD*(FLOAT(BLADES))*R
      W1=707.174*EXP(.00539*S)
      W2A=324.550*ALOG(WG)-3021.510
      W2B=-18.+2.83*STT
      W3=2.9818*SB-1321.921
      IF (COUNT.NE.0.) GO TO 260
      W4=258.358*EXP(.000041*WG)
260   CONTINUE
      W5=.014*(.2041*WG)**1.136
      W6A=(348.+.910*HP)*FLOAT(NENG)
      W6B=(.999*HP**.959)
      W6C=(454.619*(FUEL/6.5)**(-.0566))
      W7=.00334*WG**1.224
      W8=139.0
      W9=68.266*ALOG(HP)-387.598
      W10=(6.63E-7)*WG**1.863
      W11=9.780*SB**.539
      W12=(16744.967*ALOG(HP)-108666.)**.536*1.90
      W13=.159*SB+18.11*FLOAT(PEOPLE)
      W14=117.771*ALOG(SB)-710.594
      W15=-72.+.111*SB+3.49*FLOAT(PEOPLE)
270   CONTINUE
```

```
      REVWE=W1+W2A+W2B+W3+W4+W5+W6A+W6B+W6C+W7+W8+W9+W10+W11+W12+W13+W14
     1+W15
      REVWG=REVWE+FUEL+USELOD
      WRITE (6,1760) B,PIHP,POHP,PTHP,WE,FUEL,PEOPLE,USELOD,NENG,WG,SIGM
     1A,R,HP,W1,W2A,W2B,W3,W4
      WRITE (6,1770) W5,W6A,W6B,W6C,W7,W8,W9,W10,W11,W12,W13,W14,W15,REV
     1WE,REVWG
      WRITE (8,1760) B,PIHP,POHP,PTHP,WE,FUEL,PEOPLE,USELOD,NENG,WG,SIGM
     1A,R,HP,W1,W2A,W2B,W3,W4
      WRITE (8,1770) W5,W6A,W6B,W6C,W7,W8,W9,W10,W11,W12,W13,W14,W15,REV
     1WE,REVWG
C***********************************************************************
C     3.3 VALIDATE DISC LOADING                                        *
C***********************************************************************
      WRITE (6,1800) WG
      READ (5,*) ANS
      CALL FRTCMS ('CLRSCRN 6')
      IF (ANS.NE.1.) GO TO 280
      WRITE (6,1810)
      READ (5,*) DL
      CALL FRTCMS ('CLRSCRN 6')
      WG=REVWG
      WE=REVWE
      TRIP1=1.
      TRIP2=2.
      GO TO 30
280   CONTINUE
C***********************************************************************
C     3.4 ESTABLISH FIGURE OF MERIT AT APPROXIMATELY 0.75              *
C***********************************************************************
      M=(PI/PT)*100.
      WRITE (6,1780) M
      WRITE (8,1780) M
290   CONTINUE
      WRITE (6,1790)
      READ (5,*) ANS
      CALL FRTCMS ('CLRSCRN 6')
      IF (ANS.NE.1.) GO TO 300
      TRIP1=1.
      TRIP2=2.
      WG=REVWG
      WE=REVWE
      OLD=REVWG
      GO TO 30
300   IF (ANS.NE.2.) GO TO 310
      WRITE (6,2270) CHORD
      WRITE (6,1870)
      READ (5,*) CHORD
```

```
      CALL FRTCMS ('CLRSCRN 6')
      WG=REVWG
      WE=REVWE
      OLD=REVWG
      SIGMA=(FLOAT(BLADES)*CHORD)/(PIE*R)
      TRIP1=1.
      TRIP2=2.
      GO TO 70
310   IF (ANS.NE.3.) GO TO 320
      WRITE (6,1680)
      READ (5,*) OMEGA
      CALL FRTCMS ('CLRSCRN 6')
      TRIP1=1.
      TRIP2=2.
      WE=REVWE
      WG=REVWG
      OLD=REVWG
      GO TO 40
320   CONTINUE
C*********************************************************************
C     3.5 REFINE GROSS WEIGHT ESTIMATE                              *
C*********************************************************************
      IF (COUNT.GE.2.) GO TO 360
      COUNT=COUNT+1.
      IF (COUNT.GT.1.) GO TO 330
      WRITE (6,2780)
      READ (5,*) LG
      CALL FRTCMS ('CLRSCRN 6')
330   CONTINUE
      IF (BLADES.GT.2) FL=4.
      IF (BLADES.LT.3) FL=2.
      IF (LG.NE.1.) GO TO 350
      IF (COUNT.GT.1.) GO TO 340
      WRITE (6,2790)
      READ (5,*) XRLG
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,2800)
      READ (5,*) NW
      CALL FRTCMS ('CLRSCRN 6')
340   CONTINUE
      W4=.4013*(WG**.6662)*(NW**.536)*(XRLG**.1198)
      WG=REVWG
      WE=REVWE
      OLD=REVWG
      GO TO 120
350   CONTINUE
      W4=.0245*(WG**.8606)*(FL**.8046)
      WG=REVWG
```

```
      WE=REVWE
      OLD=REVWG
      GO TO 120
C***********************************************************************
C     3.6 MAKE THIRD ESTIMATE OF POWER REQUIRED TO HOVER                *
C                                                                       *
C     3.7 REPEAT THE GROSS WEIGHT ESTIMATE AND THE HOVER                *
C         POWER ITERATIONS                                              *
C***********************************************************************
360   CONTINUE
      STEP=1.-(OLD/REVWG)
      IF (STEP.LT.0.1) GO TO 370
      WRITE (6,2740)
      GO TO 290
370   IF (STEP.GT.-.1) GO TO 380
      WRITE (6,2740)
      GO TO 290
380   CONTINUE
      WG=REVWG
      IF (TRIF3.EQ.3.) GO TO 390
C***********************************************************************
C     3.8 DETERMINE THE POWER REQUIRED TO HOVER IGE, SSL                *
C***********************************************************************
      WRITE (6,1820)
      READ (5,*) H
      CALL FRTCMS ('CLRSCRN 6')
      H=H+10.
390   CONTINUE
      D=2.*R
      PPOGE=-.1276*(H/D)**4+.7080*(H/D)**3-1.4569*(H/D)**2+1.3432*(H/D)+
     1.5147
      PITLGE=PPOGE*PI
      PTHOVS=PITLGE+PO
C***********************************************************************
C     3.9 DETERMINE EQUIVALENT FLAT PLATE AREA (HORIZONTAL)             *
C***********************************************************************
      WRITE (6,1600) WG
      WRITE (6,1830)
      READ (5,*) LOAD
      CALL FRTCMS ('CLRSCRN 6')
      EFPAFF=WG/LOAD
      KNTS=0.0
      WRITE (6,1840)
      WRITE (8,1840)
C***********************************************************************
C     3.10 DETERMINE TOTAL POWER REQUIRED AND TIP MACH                  *
C          NUMBER                                                       *
C***********************************************************************
```

```
      NN=AINT(MAXV/5.)+1
      N=AINT(MAXV/5.)+11
      DO 400 I=1,N
      VF=KNTS*1.151*5280./3600.
      PPF=.5*RHOSL*(VF**3)*EFPAFF
      PPF=PPF/550.
      MU=VF/VTIP
      POF=(1.+4.3*MU**2)*PO
      POF=POF/550.
      VI=SQRT(WG/(2.*RHOSL*AREAMR))
      VIT=VI*SQRT((-(VF**2/(2.*VI**2)))
     1                 +SQRT(((VF**2/(2.*VI**2))**2)+1.))
      PITLF=(1./B)*WG*VIT
      PITLF=PITLF/550.
      PTF=PITLF+PCF+PPF
      MACHT=(VF+VTIP)/A
      PPFS(I)=PPF
      POFS(I)=POF
      PITLFS(I)=PITLF
      PTFS(I)=PTF
      WRITE (6,1850)  KNTS,MACHT,PITLF,POF,PPF,PTF
      WRITE (8,1850)  KNTS,MACHT,PITLF,POF,PPF,PTF
      KNTS=KNTS+5.
  400 CONTINUE
      TEMP=TEMP+460.
      THETA=TEMP/518.688
      CONST=6.87535E-6
      PRESS=2116.22*(1.-CONST*PA)**5.2561
      SIG=PRESS/2116.22
      RHOALT=.0023769*SIG*THETA
      AALT=SQRT(1.4*32.174*53.3*TEMP)
      WRITE (6,1860)
      WRITE (8,1860)
      KNTS=0.0
      DO 410 I=1,N
      VF=KNTS*1.151*5280./3600.
      PPF=.5*RHOALT*(VF**3)*EFPAFF
      PPF=PPF/550.
      MU=VF/VTIP
      PO=.125*SIGMA*CDO*RHOALT*AREAMR*VTIP**3
      POF=(1.+4.3*MU**2)*PO
      POF=POF/550.
      VI=SQRT(WG/(2.*RHOALT*AREAMR))
      VIT=VI*SQRT((-(VF**2/(2.*VI**2)))
     1                 +SQRT(((VF**2/(2.*VI**2))**2)+1.))
      PITLF=(1./B)*WG*VIT
      PITLF=PITLF/550.
      PTF=PITLF+PCF+PPF
```

```
      MACHT=(VF+VTIP)/AALT
      PPFA(I)=PPF
      POFA(I)=POF
      PITLFA(I)=PITLF
      PTFA(I)=PTF
      WRITE (6,1850) KNTS,MACHT,PITLF,POF,PPF,PTF
      WRITE (8,1850) KNTS,MACHT,PITLF,POF,PPF,PTF
      KNTS=KNTS+5.
410   CONTINUE
C************************************************************************
C     4.1 MAKE PRELIMINARY SIZING OF TAIL ROTOR                         *
C************************************************************************
      RTR=1.3*SQRT(WG/1000.)
      WRITE (6,1880) RTR
      WRITE (8,1880) RTR
      OMEGTR=4.5*OMEGA
      WRITE (6,1890) OMEGTR
      WRITE (8,1890) OMEGTR
      CDOTR=1.38*CDO
      WRITE (6,1900) CDOTR
      WRITE (8,1900) CDOTR
      IF (TRIP3.EQ.3.) GO TO 420
      WRITE (6,1910)
      READ (5,*) BLADTR
      CALL FRTCMS ('CLRSCRN 6')
420   CONTINUE
      LTR=R+RTR+.5
      IF (TRIP3.EQ.3.) GO TO 430
      WRITE (6,1920)
      READ (5,*) ARTR
      CALL FRTCMS ('CLRSCRN 6')
430   CONTINUE
      CHORDT=RTR/ARTR
      SIGTR=(FLOAT(BLADTR)*CHORDT)/(PIE*RTR)
C************************************************************************
C     4.2 DETERMINE TAIL ROTOR POWER REQUIRED AT HOVER                  *
C************************************************************************
      AREATR=PIE*RTR**2
      TTR=PT/(OMEGA*LTR)
      VTIPTR=OMEGTR*RTR
      CTTR=TTR/(AREATR*RHOSL*VTIPTR**2)
      BTR=1.-SQRT(2.*CTTR)/FLOAT(BLADTR)
      PITLTR=(1./BTR)*(TTR**1.5/SQRT(2.*RHOSL*AREATR))
      POTR=.125*SIGTR*CDOTR*RHOSL*AREATR*(VTIPTR**3)
      PTTRH=PITLTR+POTR
      PTTRHP=PTTRH/550.
      CTTA=TTR/(AREATR*RHOALT*VTIPTR**2)
      BTA=1.-SQRT(2.*CTTA)/FLOAT(BLADTR)
```

```
      PITLTA=(1./BTA)*(TTR**1.5/SQRT(2.*RHOALT*AREATR))
      POTA=.125*SIGTR*CDOTR*RHOALT*AREATR*(VTIPTR**3)
      PTTAH=PITLTR+POTR
      PTTAHP=PTTRF/550.
C*************************************************************************
C     4.3 DETERMINE TAIL ROTOR POWER REQUIRED FOR FORWARD              *
C         FLIGHT                                                        *
C                                                                       *
C     4.5 DETERMINE MAXIMUM TIP MACH NUMBER FOR FORWARD                 *
C         FLIGHT                                                        *
C*************************************************************************
      KNTS=0.0
      WRITE (6,1930)
      WRITE (8,1930)
      DO 440 I=1,N
      VF=KNTS*1.151*5280./3600.
      MUTR=VF/VTIPTR
      POTRF=(1.+4.3*MUTR**2)*POTR
      POTRF=POTRF/550.
      PTF=PTFS(I)
      TTR=((PTF*550.)/(OMEGA*LTR))
      CTTR=TTR/(AREATR*RHOSL*(VTIPTR**2))
      BTR=1.-SQRT(2.*CTTR)/FLOAT(BLADTR)
      VITR=SQRT(TTR/(2.*RHOSL*AREATR))
      VITTR=VITR*SQRT((-(VF**2/(2.*VITR**2)))
     1+SQRT(((VF**2/(2.*VITR**2))**2)+1.))
      PITLTF=(1./BTR)*TTR*VITTR
      PITLTF=PITLTF/550.
      PTTRF=PITLTF+POTRF
      POTRFS(I)=POTRF
      PITRFS(I)=PITLTF
      PTTRFS(I)=PTTRF
      MTTR=(VF+VTIPTR)/A
      WRITE (6,1950) KNTS,MTTR,PITLTF,POTRF,PTTRF
      WRITE (8,1950) KNTS,MTTR,PITLTF,POTRF,PTTRF
      KNTS=KNTS+5.
440   CONTINUE
      WRITE (6,1940)
      WRITE (8,1940)
      KNTS=0.0
      DO 450 I=1,N
      VF=KNTS*1.151*5280./3600.
      MUTR=VF/VTIPTR
      POTR=.125*SIGTR*CDOTR*RHOALT*AREATR*VTIPTR**3
      POTRF=(1.+4.3*MUTR**2)*POTR
      POTRF=POTRF/550.
      PTF=PTFA(I)
      TTR=((PTF*550.)/(OMEGA*LTR))
```

```
      CTTR=TTR/(AREATR*(VTIPTR**2)*RHOALT)
      BTR=1.-SQRT(2.*CTTR)/FLOAT(BLADTR)
      VITR=SQRT(TTR/(2.*RHOALT*AREATR))
      VITTR=VITR*SQRT((-(VF**2/(2.*VITR**2)))
     1+SQRT(((VF**2/(2.*VITR**2))**2)+1.))
      PITLTF=(1./ETR)*TTR*VITTR
      PITLTF=PITLTF/550.
      PTTRF=PITLTF+POTRF
      POTRFA(I)=POTRF
      PITRFA(I)=PITLTF
      PTTRFA(I)=PTTRF
      MTTR=(VF+VTIPTR)/AALT
      WRITE (6,1950) KNTS,MTTR,PITLTF,POTRF,PTTRF
      WRITE (8,1950) KNTS,MTTR,PITLTF,POTRF,PTTRF
      KNTS=KNTS+5.
450   CONTINUE
C*****************************************************************
C     4.4 VERTICAL STABILIZER                                    *
C*****************************************************************
      IF (TRIP3.EQ.3.) GO TO 460
      WRITE (6,2960)
      READ (5,*) BVS
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,2970) SIGTR
      READ (5,*) VS
      CALL FRTCMS ('CLRSCRN 6')
460   CONTINUE
      VF80=80.*1.151*5280./3600.
      VF160=160.*1.151*5280./3600.
      ARVS=BVS**2/VS
      TTR80=(PTFS(17)*550.)/(LTR*OMEGA)
      TTR160=(PTFS(34)*550.)/(LTR*OMEGA)
      CL80=(2.*TTR80)/(RHOSL*VF80**2*VS)
      CL160=(2.*TTR160)/(RHOSL*VF160**2*VS)
      CLARVS=((2.*PIE)/(2.+SQRT(ARVS**2*2.+4.)))*ARVS*PIE/180.
      A80=((CL80-.4)/CLARVS)
      A160=((CL160-.4)/CLARVS)
      WRITE (6,2980) CL80,CL160,A80,A160
      WRITE (8,2980) CL80,CL160,A80,A160
C*****************************************************************
C     5.1 DETERMINE RETREATING BLADE STALL EFFECTS               *
C                                                                *
C     5.2 DETERMINE STALL POWER INCREMENT                        *
C                                                                *
C     5.3 DETERMINE COMPRESSIBILITY EFFECTS                      *
C*****************************************************************
      KNT=0.
      TWIST=-10.*PIE/180.
```

```
      IF (TRIP3.EQ.3.) GO TO 470
      WRITE (6,2930)
      READ (5,*) MCRO
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,2940)
      READ (5,*) CLMAX
      CALL FRTCMS ('CLRSCRN 6')
470   CONTINUE
      AMAX=CLMAX/CLA
      WRITE (8,2920) R,CHORD,BLADES,WG,VTIP,EFPAFF,NENG,H,RHOALT,AALT,TW
     1IST,CLMAX,AMAX,CLA,CDO,MCRO
      CT=WG/(AREAMR*RHOALT*(VTIP**2))
      IF (H/D.GT.1.55) PPOGE=1.0
      B=1.0-(SQRT(2.*CT)/FLOAT(BLADES))
      WRITE (8,2910) CT,AREAMR,SIGMA,B,PPOGE
      VMAX=SQRT(WG/2./RHOALT/AREAMR)*(4./(EFPAFF/AREAMR))**.333334
      VMAXK=VMAX/1.68894
      VELMAX=VMAXK
      DO 630 I=1,N
      WRITE (8,2880) KNT
      VF=KNT*1.151*5280./3600.
      MU=VF/VTIP
      VL=VF**2/(2.*VI**2)
      C1=(B**2+.5*MU**2)
      C2=(B**2-.5*MU**2)
      T1=.5*C1
      T2=(B**3)/3.+(MU**2*B*.5)
      T3=(B**2/4.)*(B**2+MU**2)
      T4=(MU/2.)*(B**2+MU**2/4.)
      AI1=((B**2*MU*.5-(MU**3/8.))*4.)/(B**2*C2)
      AI2=(8.*MU*B)/(3.*C2)
      AI3=(2.*MU*B**2)/C2
      AI4=(B**2+1.5*MU**2)/C2
      IF (VF.GT.0.) GO TO 480
      ALPHA=0.
      WRITE (8,2900) ALPHA
480   LAMBD1=-SQRT(CT/2.)
      IF (MU.LE.0.1) GO TO 510
      IF (VF.EQ.0.) DP=0.
      IF (VF.EQ.0.) GO TO 490
      DP=PPFA(I)*550/VF
      ALPHA=-DP/WG
490   CONTINUE
500   LAMBDA=-CT/SQRT(2*(LAMBD1**2)+MU**2)+MU*TAN(ALPHA)
      DLAMB=LAMBDA-LAMBD1
      LAMBD1=LAMBDA
      LREF=ABS(DLAMB)
      IF (LREF.GE.LERR) GO TO 500
```

```
510   LAMBDA=LAMBD1
      E1=(2.*CT)/(SIGMA*CLA)
      E2=T1*LAMBDA
      E3=T3*TWIST
      D1=((2.*CT)/(SIGMA*CLA))-T1*LAMBDA-TWIST*T3
      D2=-(A11*LAMBDA)-(TWIST*A13)
      CYCLIC=((D2*T2)-(D1*A12))/(T2*A14-T4*A12)
      COLL=(D1-T4*CYCLIC)/T2
      CYCD=CYCLIC*57.29578
      COLLD=COLL*57.29578
      THETA0=COLL*57.29578
      THETA2=CYCLIC*57.29578
      WRITE (8,2830) A11,A12,A13,A14,T1,T2,T3,T4,LAMBDA
      GAM=AMAX-COLL+CYCLIC
      CS=MU*GAM+LAMBDA
      BS=-MU*TWIST-GAM
      RT=(BS**2-4.*TWIST*CS)
      WRITE (8,2860) RT
      IF (RT) 560,520,520
520   XS=(-BS+SQRT(RT))/(2.*TWIST)
      XO=-XS-BS/TWIST
      IF (XS-1.) 530,560,560
530   IF (XS) 560,560,540
540   CPS=(SIGMA/(24.*PIE))*((1.-MU)**2)*(1.-XS)*SQRT(1.-XS**2)
      IF ((XS+XO)/2..GE.1.0) KS=1.0
      IF ((XS+XO)/2..GT.1.0) GO TO 550
      KS=-(BS/(2.*TWIST)+XS)/(1.-XS)
550   CPS=KS*CPS
      GO TO 570
560   CPS=0.0
      KS=0.0
570   PS=CPS*RHOALT*AREAMR*(VTIP**3)/550.
      WRITE (8,2840) KS,CPS
      A90=COLL+CYCLIC+TWIST+LAMBDA/(1.+MU)
      A270=COLL-CYCLIC+TWIST+LAMBDA/(1.+MU)
      A90D=A90*57.29278
      A270D=A270*57.29278
      WRITE (8,2850) CYCD,COLLD,A90D,A270D
      MTIP=(VF+VTIP)/AALT
      MCRIT=MCRO-CLA*A90*.113
      IF (MTIP-1.) 590,580,580
580   WRITE (8,2890)
      GO TO 610
590   MD=MTIP-MCRIT-0.06
      IF (MD) 610,610,600
600   CPC=SIGMA*(0.012*MD+.1*(MD**3))
      GO TO 620
610   CPC=0.0
```

```
      MD=0.0
620   PMBS=CPC*RHCALT*AREAMR*(VTIP**3)/550.
      PCMPA(I)=PMES+PS
      WRITE (8,2870) MTIP,MCRIT,MD,CPC,PITLFA(I),POFA(I),PPFA(I),PMBS,PS
     1,PCMPA(I)
      TSHP=1.13*PCMPA(I)+10.0
      VOPT=SQRT(WG/RHOALT/AREAMR*SQRT(AREAMR/3./EFPAFF))
      VOPTK=VCPT/1.68894
      KNT=KNT+5.
630   CONTINUE
      KNT=0.
      K=MAXV+40
      WRITE (6,2430)
      WRITE (8,2430)
      DO 690 I=1,K
      VF=KNT*1.151*5280./3600.
      MU=VF/VTIP
      PP=(.5*RHOALT*EFPAFF*(VF**3))/550.
      C1=(B**2+.5*MU**2)
      C2=(B**2-.5*MU**2)
      T1=.5*C1
      T2=(B**3)/3.+(MU**2*B*.5)
      T3=(B**2/4.)*(B**2+MU**2)
      T4=(MU/2.)*(B**2+MU**2/4.)
      A11=((B**2*MU*.5-(MU**3/8.))*4.)/(B**2*C2)
      A12=(8.*MU*B)/(3.*C2)
      A13=(2.*MU*B**2)/C2
      A14=(B**2+1.5*MU**2)/C2
      IF (VF.GT.0.) GO TO 640
      ALPHA=0.
      GO TO 650
640   ALPHA=-(PP*550.)/VF/WG
650   LAMBD1=-SQRT(CT/2.)
      IF (MU.LE.0.1) GO TO 670
660   LAMBDA=-CT/SQRT(2*(LAMBD1**2)+MU**2)+MU*TAN(ALPHA)
      DLAMB=LAMBDA-LAMBD1
      LAMBD1=LAMBCA
      LREF=ABS(DLAMB)
      IF (LREF.GE.LERR) GO TO 660
670   IF (MU.LE.0.1) LAMBDA=LAMBD1
      E1=(2.*CT)/(SIGMA*CLA)
      E2=T1*LAMBDA
      E3=T3*TWIST
      D1=((2.*CT)/(SIGMA*CLA))-T1*LAMBDA-TWIST*T3
      D2=-(A11*LAMBDA)-(TWIST*A13)
      CYCLIC=((D2*T2)-(D1*A12))/(T2*A14-T4*A12)
      COLL=(D1-T4*CYCLIC)/T2
      THETAO=CCLL*57.29578
```

```
      THETA2=CYCLIC*57.29578
      A270=CCLL-CYCLIC+TWIST+LAMBDA/(1.+MU)
      A270D=A270*57.29278
      DA270=A270-AMAX
      DREF=ABS(DA270)
      IF (A270D.LT.12.) GO TO 680
      IF (A270D.GT.13.) GO TO 680
      VSK=VF/1.68894
      WRITE (6,2440) VSK,A270D
      WRITE (8,2440) VSK,A270D
680   CONTINUE
      KNT=KNT+1.
690   CONTINUE
      KNT=0.
      CT=WG/(AREAMR*RHOSL*(VTIP**2))
      IF (H/D.GT.1.55) PPOGE=1.0
      B=1.0-(SQRT(2.*CT)/FLOAT(BLADES))
      VMAX=SQRT(WG/2./RHOSL/AREAMR)*(4./(EFPAFF/AREAMR))**.333334
      VMAXK=VMAX/1.68894
      DO 850 I=1,N
      VF=KNT*1.151*5280./3600.
      MU=VF/VTIP
      VL=VF**2/(2.*VI**2)
      C1=(B**2+.5*MU**2)
      C2=(B**2-.5*MU**2)
      T1=.5*C1
      T2=(B**3)/3.+(MU**2*B*.5)
      T3=(B**2/4.)*(B**2+MU**2)
      T4=(MU/2.)*(B**2+MU**2/4.)
      A11=((B**2*MU*.5-(MU**3/8.))*4.)/(B**2*C2)
      A12=(8.*MU*B)/(3.*C2)
      A13=(2.*MU*B**2)/C2
      A14=(B**2+1.5*MU**2)/C2
      IF (VF.GT.0.) GO TO 700
      ALPHA=0.
700   LAMBD1=-SQRT(CT/2.)
      IF (MU.LE.0.1) GO TO 730
      IF (VF.EQ.0.) DP=0.
      IF (VF.EQ.0.) GO TO 710
      DP=PPFS(I)*550/VF
      ALPHA=-DP/WG
710   CONTINUE
720   LAMBDA=-CT/SQRT(2*(LAMBD1**2)+MU**2)+MU*TAN(ALPHA)
      DLAMB=LAMBDA-LAMBD1
      LAMBD1=LAMBDA
      LREF=ABS(DLAMB)
      IF (LREF.GE.LERR) GO TO 720
730   LAMBDA=LAMBD1
```

```
      E1=(2.*CT)/(SIGMA*CLA)
      E2=T1*LAMBDA
      E3=T3*TWIST
      D1=((2.*CT)/(SIGMA*CLA))-T1*LAMBDA-TWIST*T3
      D2=-(A11*LAMBDA)-(TWIST*A13)
      CYCLIC=((D2*T2)-(D1*A12))/(T2*A14-T4*A12)
      COLL=(D1-T4*CYCLIC)/T2
      THETA0=CCLL*57.29578
      THETA2=CYCLIC*57.29578
      GAM=AMAX-COLL+CYCLIC
      CS=MU*GAM+LAMBDA
      BS=-MU*TWIST-GAM
      RT=(BS**2-4.*TWIST*CS)
      IF (RT) 780,740,740
740   XS=(-BS+SQRT(RT))/(2.*TWIST)
      X0=-XS-BS/TWIST
      IF (XS-1.) 750,780,780
750   IF (XS) 780,780,760
760   CPS=(SIGMA/(24.*PIE))*((1.-MU)**2)*(1.-XS)*SQRT(1.-XS**2)
      IF ((XS+X0)/2..GE.1.0) KS=1.0
      IF ((XS+X0)/2..GT.1.0) GO TO 770
      KS=-(BS/(2.*TWIST)+XS)/(1.-XS)
770   CPS=KS*CPS
      GO TO 790
780   CPS=0.C
      KS=0.0
790   PS=CPS*RHOSL*AREAMR*(VTIP**3)/550.
      A90=COLL+CYCLIC+TWIST+LAMBDA/(1.+MU)
      A270=COLL-CYCLIC+TWIST+LAMBDA/(1.+MU)
      A90D=A9C*57.29278
      A270D=A270*57.29278
      MTIP=(VF+VTIP)/AALT
      MCRIT=MCRO-CLA*A90*.113
      IF (MTIP-1.) 810,800,800
800   CONTINUE
      GO TO 830
810   MD=MTIF-MCRIT-0.06
      IF (MD) 830,830,820
820   CPC=SIGMA*(C.012*MD+.1*(MD**3))
      GO TO 840
830   CPC=0.0
      MD=0.0
840   PMBS=CPC*RHCSL*AREAMR*(VTIP**3)/550.
      PCMPS(I)=PMBS+PS
      TSHP=1.13*PCMPS(I)+10.0
      VOPT=SQRT(WG/RHCSL/AREAMR*SQRT(AREAMR/3./EFPAFF))
      VOPTK=VOPT/1.68894
      KNT=KNT+5.
```

```
850     CONTINUE
        KNT=0.
        DO 900 I=1,K
        VF=KNT*1.151*5280./3600.
        MU=VF/VTIP
        PP=(.5*RHOSL*EFPAFF*(VF**3))/550.
        C1=(B**2+.5*MU**2)
        C2=(B**2-.5*MU**2)
        T1=.5*C1
        T2=(B**3)/3.+(MU**2*B*.5)
        T3=(B**2/4.)*(B**2+MU**2)
        T4=(MU/2.)*(B**2+MU**2/4.)
        A11=((B**2*MU*.5-(MU**3/8.))*4.)/(B**2*C2)
        A12=(8.*MU*B)/(3.*C2)
        A13=(2.*MU*B**2)/C2
        A14=(B**2+1.5*MU**2)/C2
        IF (VF.GT.0.) GO TO 860
        ALPHA=0.
        GO TO 870
860     ALPHA=-(PP*550.)/VF/WG
870     LAMBD1=-SQRT(CT/2.)
        IF (MU.LE.0.1) GO TO 890
880     LAMBDA=-CT/SQRT(2*(LAMBD1**2)+MU**2)+MU*TAN(ALPHA)
        DLAMB=LAMBDA-LAMBD1
        LAMBD1=LAMBDA
        LREF=ABS(DLAMB)
        IF (LREF.GE.LERR) GO TO 880
890     IF (MU.LE.0.1) LAMBDA=LAMBD1
        E1=(2.*CT)/(SIGMA*CLA)
        E2=T1*LAMBDA
        E3=T3*TWIST
        D1=((2.*CT)/(SIGMA*CLA))-T1*LAMBDA-TWIST*T3
        D2=-(A11*LAMBDA)-(TWIST*A13)
        CYCLIC=((D2*T2)-(D1*A12))/(T2*A14-T4*A12)
        COLL=(D1-T4*CYCLIC)/T2
        THETA0=COLL*57.29578
        THETA2=CYCLIC*57.29578
        A270=COLL-CYCLIC+TWIST+LAMBDA/(1.+MU)
        A270D=A270*57.29278
        DA270=A270-AMAX
        DREF=ABS(DA270)
        KNT=KNT+1.
900     CONTINUE
        WRITE (6,2950)
        READ (5,*) FBS
        CALL FRTCMS ('CLRSCRN 6')
C*******************************************************************
C       5.4 DETERMINE TOTAL POWER REQUIRED                         *
```

```
C***********************************************************************
      PTAH=PT+PTTRH
      PTAH=PTAH/550.
      WRITE (6,1960) PTAH
      WRITE (8,1960) PTAH
      KNOTS(1)=0.
      WRITE (6,1970)
      WRITE (8,1970)
      DO 910 I=1,N
      POX(I)=POFS(I)+POTRFS(I)
      PIX(I)=PITLFS(I)+PITRFS(I)
      PPX(I)=PPFS(I)
      PTX(I)=POX(I)+PIX(I)+PPX(I)+PCMPS(I)
      WRITE (6,1980) KNOTS(I),PIX(I),POX(I),PPX(I),PCMPS(I),PTX(I)
      WRITE (8,1980) KNOTS(I),PIX(I),POX(I),PPX(I),PCMPS(I),PTX(I)
      KNOTS(I+1)=KNOTS(I)+5.
910   CONTINUE
      WRITE (6,1990)
      WRITE (8,1990)
      KNOTS(1)=0.
      DO 920 I=1,N
      POY(I)=POFA(I)+POTRFA(I)
      PIY(I)=PITLFA(I)+PITRFA(I)
      PPY(I)=PPFA(I)
      PTY(I)=POY(I)+PIY(I)+PPY(I)+PCMPA(I)
      WRITE (6,1980) KNOTS(I),PIY(I),POY(I),PPY(I),PCMPA(I),PTY(I)
      WRITE (8,1980) KNOTS(I),PIY(I),POY(I),PPY(I),PCMPA(I),PTY(I)
      KNOTS(I+1)=KNOTS(I)+5.
920   CONTINUE
C***********************************************************************
C     5.5 DETERMINE THE RSHP REQUIRED AT MAXIMUM VELOCITY              *
C***********************************************************************
      PADJS=PTX(NN)+PCMPS(NN)
      PADJA=PTY(NN)+PCMPA(NN)
      IF (PADJS.GT.PADJA) GO TO 930
      RRSHP=PADJA
      GO TO 940
930   RRSHP=PADJS
940   CONTINUE
      WRITE (6,2000) RRSHP
      WRITE (8,2000) RRSHP
C***********************************************************************
C     5.6 DETERMINE RSHP FOR HOVER CEILING, IGE                        *
C***********************************************************************
      RHOS=.0023769*(1.-CONST*HOVIGE)**4.2561
      CTH=WG/(AREAMR*RHOS*VTIP**2)
      BH=1.-SQRT(2.*CTH)/FLOAT(BLADES)
      PITLH=(1./BH)*(WG**1.5/SQRT(2.*RHOS*AREAMR))
```

```
      PPOGEH=-.1276*(H/D)**4+.708*(H/D)**3-1.4569*(H/D)**2+1.3432*(H/D)+
     1.5147
      PITLGH=PPOGEH*PITLH
      POH=.125*SIGMA*CDO*RHOS*AREAMR*VTIP**3
      PTH=PITLGH+POH
      TTR=PTH/(OMEGA*LTR)
      VTIPTR=CMEGTR*RTR
      CTTR=TTR/(AREATR*RHOS*VTIPTR**2)
      BTR=1.-SQRT(2.*CTTR)/FLOAT(BLADTR)
      PITLTR=(1./BTR)*(TTR**1.5/SQRT(2.*RHOS*AREATR))
      POTR=.125*SIGTR*CDOTR*RHOS*AREATR*(VTIPTR**3)
      PTTRH=PITLTR+POTR
      PTACH=PTH+PTTRH
      PTACH=PTACH/550.
C***********************************************************************
C     5.7 DETERMINE THE MAXIMUM RSHP REQUIRED                           *
C***********************************************************************
      IF (PTACH.GT.RRSHP) GO TO 950
      RSHPM=RRSHP
      GO TO 960
950   RSHPM=PTACH
960   CONTINUE
C***********************************************************************
C     5.8 DETERMINE THE TOTAL ESHP REQUIRED                             *
C***********************************************************************
      ESHPR=(.1*RSHPM*FLOAT(NENG-1))+1.03*RSHPM+10.
      WRITE (6,2010) NENG,ESHPR
      WRITE (8,2010) NENG,ESHPR
C***********************************************************************
C     6.1 SELECT TYPE AND NUMBER OF ENGINES                             *
C                                                                       *
C     6.2 INSTALLATION WEIGHT                                           *
C***********************************************************************
      WRITE (6,2020) NENG
      WRITE (6,2030)
      READ (5,*) ANS
      CALL FRTCMS ('CLRSCRN 6')
      IF (ANS.NE.1.) GO TO 970
      WRITE (6,2040)
      READ (5,*) NENG
      CALL FRTCMS ('CLRSCRN 6')
      GO TO 960
970   CONTINUE
      HL=(AASLY*AFHPY)
      PM(1)=.025
      WRITE (6,2060)
      WRITE (8,2080)
      DO 1100 I=1,6
```

```
      YMC(I)=AFHPY*PM(I)
      YOC(I)=AFHPY*OC(I)
      NRPL(I)=((HL/MTBR(I))-1.)
      NXRPL(I)=AINT(((HL)/MTBR(I))-1.)
      IF (NRPL(I).NE.1.0) GO TO 980
      GO TO 1090
980   IF (NRPL(I).NE.2.) GO TO 990
      GO TO 1090
990   IF (NRPL(I).NE.3.) GO TO 1000
      GO TO 1090
1000  IF (NRPL(I).NE.4.0) GO TO 1010
      GO TO 1090
1010  IF (NRPL(I).NE.5.) GO TO 1020
      GO TO 1090
1020  IF (NRPL(I).NE.6.) GO TO 1030
      GO TO 1090
1030  IF (NRPL(I).NE.7.0) GO TO 1040
      GO TO 1090
1040  IF (NRPL(I).NE.8.) GO TO 1050
      GO TO 1090
1050  IF (NRPL(I).NE.9.) GO TO 1060
      GO TO 1090
1060  IF (NRPL(I).NE.10.0) GO TO 1070
      GO TO 1090
1070  IF (NRPL(I).NE.11.) GO TO 1080
      GO TO 1090
1080  CONTINUE
      NRPL(I)=NXRPL(I)+1.
1090  CONTINUE
      EIW(I)=CW(I)+IF(I)*DW(I)
      RC(I)=1.35*IC(I)
      SV(I)=.8*IC(I)
      WXO(I)=.35*SHPM(I)
      LAMFR(I)=1./MTBF(I)
      RELY(I)=EXP((-LAMFR(I))*AFHPF)
      AVAIL(I)=MTBMA(I)/(MTBMA(I)+MDT(I))
      LCC(I)=(RDC(I)+IC(I)+HL*(YOC(I)+YMC(I))
     1        +NRPL(I)*(RC(I)-SV(I)))*.0001
      MAINT(I)=MDT(I)/AFHPF
1100  CONTINUE
      WRITE (6,2100) (DW(I),I=1,6)
      WRITE (8,2100) (DW(I),I=1,6)
      WRITE (6,2110) (LCC(I),I=1,6)
      WRITE (8,2110) (LCC(I),I=1,6)
      WRITE (6,2120) (MTBR(I),I=1,6)
      WRITE (8,2120) (MTBR(I),I=1,6)
      WRITE (6,2130) (NRPL(I),I=1,6)
      WRITE (8,2130) (NRPL(I),I=1,6)
```

```
      WRITE (6,2140) (RDC(I),I=1,6)
      WRITE (8,2140) (RDC(I),I=1,6)
      WRITE (6,2150) (IC(I),I=1,6)
      WRITE (8,2150) (IC(I),I=1,6)
      WRITE (6,2160) (YMC(I),I=1,6)
      WRITE (8,2160) (YMC(I),I=1,6)
      WRITE (6,2170) (YOC(I),I=1,6)
      WRITE (8,2170) (YOC(I),I=1,6)
      WRITE (6,2180) (RC(I),I=1,6)
      WRITE (8,2180) (RC(I),I=1,6)
      WRITE (6,2190) (SV(I),I=1,6)
      WRITE (8,2190) (SV(I),I=1,6)
      WRITE (6,2200) (AVAIL(I),I=1,6)
      WRITE (8,2200) (AVAIL(I),I=1,6)
      WRITE (6,2210) (RELY(I),I=1,6)
      WRITE (8,2210) (RELY(I),I=1,6)
      WRITE (6,2220) (MAINT(I),I=1,6)
      WRITE (8,2220) (MAINT(I),I=1,6)
      WRITE (6,2230) (SHPM(I),I=1,6)
      WRITE (8,2230) (SHPM(I),I=1,6)
      WRITE (6,2090) NENG
      WRITE (8,2090) NENG
      DO 1230 I=1,6
      DWM(I)=CW(I)*FLOAT(NENG)
      ICM(I)=IC(I)*FLOAT(NENG)
      SHPMM(I)=SHPM(I)*FLOAT(NENG)
      RDCM(I)=RDC(I)*FLOAT(NENG)
      MTBRM(I)=MTBR(I)
      YMCM(I)=YMC(I)*FLOAT(NENG)
      YOCM(I)=YOC(I)*FLOAT(NENG)
      NRPLM(I)=((HL/MTBR(I))-1.)*FLOAT(NENG)
      NXRPLM(I)=((AINT((HL)/MTBR(I)))-1.)*FLOAT(NENG)
      IF (NRPLM(I).NE.1.0) GO TO 1110
      GO TO 1220
1110  IF (NRPLM(I).NE.2.) GO TO 1120
      GO TO 1220
1120  IF (NRPLM(I).NE.3.) GO TO 1130
      GO TO 1220
1130  IF (NRPLM(I).NE.4.0) GO TO 1140
      GO TO 1220
1140  IF (NRPLM(I).NE.5.) GO TO 1150
      GO TO 1220
1150  IF (NRPLM(I).NE.6.) GO TO 1160
      GO TO 1220
1160  IF (NRPLM(I).NE.7.0) GO TO 1170
      GO TO 1220
1170  IF (NRPLM(I).NE.8.) GO TO 1180
      GO TO 1220
```

```
1180  IF (NRPLM(I).NE.9.) GO TO 1190
      GO TO 1220
1190  IF (NRPLM(I).NE.10.0) GO TO 1200
      GO TO 1220
1200  IF (NRPLM(I).NE.11.) GO TO 1210
      GO TO 1220
1210  CONTINUE
      NRPLM(I)=(NXRPLM(I)+1.)
1220  CONTINUE
      EIWM(I)=EIW(I)*FLOAT(NENG)
      RCM(I)=1.35*ICM(I)
      SVM(I)=.8*ICM(I)
      WXOM(I)=.35*SHPMM(I)
      LAMFR(I)=(1./MTBF(I))
      RELYM(I)=EXP((-LAMFR(I))*AFHPF)
      AVAILM(I)=(MTBMA(I)/(MTBMA(I)+MDT(I)))
      LCCM(I)=(FLOAT(NENG))*(RDC(I)+IC(I)+HL*(YOC(I)
     1+YMC(I))+NRPL(I)*(RC(I)-SV(I)))*.0001
      MAINTM(I)=(MDT(I)/AFHPF)
1230  CONTINUE
      WRITE (6,2100) (DWM(I),I=1,6)
      WRITE (8,2100) (DWM(I),I=1,6)
      WRITE (6,2110) (LCCM(I),I=1,6)
      WRITE (8,2110) (LCCM(I),I=1,6)
      WRITE (6,2120) (MTBRM(I),I=1,6)
      WRITE (8,2120) (MTBRM(I),I=1,6)
      WRITE (6,2130) (NRPLM(I),I=1,6)
      WRITE (8,2130) (NRPLM(I),I=1,6)
      WRITE (6,2140) (RDCM(I),I=1,6)
      WRITE (8,2140) (RDCM(I),I=1,6)
      WRITE (6,2150) (ICM(I),I=1,6)
      WRITE (8,2150) (ICM(I),I=1,6)
      WRITE (6,2160) (YMCM(I),I=1,6)
      WRITE (8,2160) (YMCM(I),I=1,6)
      WRITE (6,2170) (YOCM(I),I=1,6)
      WRITE (8,2170) (YOCM(I),I=1,6)
      WRITE (6,2180) (RCM(I),I=1,6)
      WRITE (8,2180) (RCM(I),I=1,6)
      WRITE (6,2190) (SVM(I),I=1,6)
      WRITE (8,2190) (SVM(I),I=1,6)
      WRITE (6,2200) (AVAILM(I),I=1,6)
      WRITE (8,2200) (AVAILM(I),I=1,6)
      WRITE (6,2210) (RELYM(I),I=1,6)
      WRITE (8,2210) (RELYM(I),I=1,6)
      WRITE (6,2220) (MAINTM(I),I=1,6)
      WRITE (8,2220) (MAINTM(I),I=1,6)
      WRITE (6,2230) (SHPMM(I),I=1,6)
      WRITE (8,2230) (SHPMM(I),I=1,6)
```

```
      WRITE (6,2450) ESHPR
      WRITE (8,2450) ESHPR
      WRITE (6,2240)
      READ (5,*) ENGSEL
      CALL FRTCMS ('CLRSCRN 6')
C***********************************************************************
C     6.3 REVISE GROSS WEIGHT AND POWER REQUIRED                        *
C***********************************************************************
      EW=W6A+W6B
      EWNEW=EIWM(ENGSEL)+WXOM(ENGSEL)
      WGNEW=EWNEW+REVWG-EW
      WRITE (6,2300) REVWG,WGNEW
      WRITE (8,2300) REVWG,WGNEW
      COMPAR=1.-REVWG/WGNEW
      IF (COMPAR.LE..1) GO TO 1250
      WG=WGNEW
      DO 1240 I=1,6
      DWM(I)=0.
      LCCM(I)=0.
      MTBRM(I)=0.
      NRPLM(I)=0.
      RDCM(I)=0.
      ICM(I)=0.
      YMCM(I)=0.
      YOCM(I)=0.
      RCM(I)=0.
      SVM(I)=0.
      AVAILM(I)=0.
      RELYM(I)=0.
      MAINTM(I)=0.
      SHPMM(I)=0.
      NXRPLM(I)=0.
      EIWM(I)=0.
      WXOM(I)=0.
      LCCM(I)=0.
1240  CONTINUE
      TRIP3=3.
      GO TO 120
1250  IF (COMPAR.GE.-.1) GO TO 1270
      WG=WGNEW
      DO 1260 I=1,6
      DWM(I)=0.
      LCCM(I)=0.
      MTBRM(I)=0.
      NRPLM(I)=0.
      RDCM(I)=0.
      ICM(I)=0.
      YMCM(I)=0.
```

```
      YOCM(I)=0.
      RCM(I)=0.
      SVM(I)=0.
      AVAILM(I)=0.
      RELYM(I)=0.
      MAINTM(I)=0.
      SHPMM(I)=0.
      NXRPLM(I)=0.
      EIWM(I)=0.
      WXOM(I)=0.
      LCCM(I)=0.
 1260 CONTINUE
      TRIP3=3.
      GO TO 120
 1270 CONTINUE
C***********************************************************************
C     7.1 DETERMINE FUEL FLOW RATES                                    *
C***********************************************************************
      WRITE (6,2250)
      WRITE (8,2250)
      WFM=SFCM(ENGSEL)*SHPM(ENGSEL)*FLOAT(NENG)
      WFC=SFCC(ENGSEL)*SHPC(ENGSEL)*FLOAT(NENG)
      WFN=SFCN(ENGSEL)*SHPN(ENGSEL)*FLOAT(NENG)
      WRITE (6,2260) WFM,WFN,WFC
      WRITE (8,2260) WFM,WFN,WFC
C***********************************************************************
C     7.2 DETERMINE FUEL FLOW PER HORSEPOWER                           *
C***********************************************************************
      BETA=(WFM-WFC)/((SHPM(ENGSEL)-
     1      SHPC(ENGSEL))*FLOAT(NENG))
      ALPHA=(BETA*SHPM(ENGSEL)-BETA*
     1      SHPC(ENGSEL))*FLOAT(NENG)
C***********************************************************************
C     7.3 COMPUTE THE INTERCEPT AT SPECIFICATION CONDITIONS            *
C***********************************************************************
      PRESS=2116.22*(1.-CONST*PA)**5.2561
      TEMP=518.688*(1.-CONST*PA)
      THETA=TEMP/518.688
      DELTA=PRESS/2116.22
      ZHI=ALPHA*DELTA*SQRT(THETA)
      WRITE (6,2280) TEMP,PRESS,ALPHA,THETA,DELTA,ZHI
      WRITE (8,2280) TEMP,PRESS,ALPHA,THETA,DELTA,ZHI
C***********************************************************************
C     7.4 DETERMINE THE ZERO VELOCITY HORSEPOWER INCREMENT             *
C***********************************************************************
      PSHP=(FLOAT(NENG)*ALPHA*DELTA*SQRT(THETA))/BETA
      WRITE (6,2730)
      READ (5,*) TYPEM
```

```
      IF (TYPEM.NE.1.) GO TO 1280
      FSLT=45.9
      GO TO 1300
1280  IF (TYPEM.NE.2.) GO TO 1290
      FSLT=50.1
      GO TO 1300
1290  CONTINUE
      FSLT=67.2
1300  CONTINUE
      IF (TRIP5.EQ.5.) GO TO 1370
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,2290) PSHP
      WRITE (8,2290) PSHP
C************************************************************************
C     ** START OF DISSPLA SPECIFIC PORTION OF THE PROGRAM               *
C************************************************************************
      CALL HWROT('AUTO')
      CALL HWSCAL('SCREEN')
      CALL PAGE (11.,8.5)
      CALL NOBRDR
      CALL AREA2D (9.,6.)
      CALL SWISSL
      CALL THKCRV (.02)
      CALL CROSS
      CALL LINESP (2.5)
      CALL SHDCHR (90.,1,.002,1)
      CALL THKFRM (.15)
      CALL INTAXS
      CALL XAXEND ('NOENDS')
      CALL XTICKS (2)
      CALL YTICKS (5)
      CALL YAXANG (0.)
      CALL HEIGHT (.1)
      CALL MYLEGN ('  ',1)
      CALL LINES ('INDUCED POWER$',IHP,1)
      CALL LINES ('PROFILE POWER$',IHP,2)
      CALL LINES ('PARASITE POWER$',IHP,3)
      CALL LINES ('HISPEED EFFECTS$',IHP,4)
      CALL LINES ('TOTAL POWER$',IHP,5)
      CALL RESET ('HEIGHT')
      CALL XNAME ('FORWARD VELOCITY(KNOTS)$',100)
      CALL YNAME ('REQUIRED HORSEPOWER$',100)
      CALL HEADIN ('POWER VS. VELOCITY AT ALTITUDE$',
     1            -100,1.5,1)
      IF (ENGSEL.NE.1.) GO TO 1310
      CALL GRAF (0.,10.,(MAXV+50.),(-500.*FLOAT(NENG)),500.,
     1            (1000.*FLOAT(NENG)))
      GO TO 1360
```

```
1310  IF (ENGSEL.NE.2.) GC TO 1320
      CALL GRAF (C.,10.,(MAXV+50.),(-1000.*FLCAT(NENG)),500.,
     1              (1500.*FLOAT(NENG)))
      GO TO 1360
1320  IF (ENGSEL.NE.3.) GO TO 1330
      CALL GRAF (C.,10.,(MAXV+50.),(-1500.*FLOAT(NENG)),500.,
     1              (2500.*FLOAT(NENG)))
      GO TO 1360
1330  IF (ENGSEL.NE.4.) GO TO 1340
      CALL GRAF (C.,10.,(MAXV+50.),(-1500.*FLCAT(NENG)),500.,
     1              (2500.*FLOAT(NENG)))
      GO TO 1360
1340  IF (ENGSEL.NE.5.) GO TO 1350
      CALL GRAF (C.,10.,(MAXV+50.),(-1500.*FLOAT(NENG)),500.,
     1              (3500.*FLOAT(NENG)))
      GO TO 1360
1350  CONTINUE
      CALL GRAF (C.,10.,(MAXV+50.),(-1500.*FLCAT(NENG)),
     1        500.,(4500.*FLOAT(NENG)))
1360  CONTINUE
      CALL POLY3
      CALL DCT
      CALL LEGLIN
      CALL CURVE (KNOTS,PIY,N,0)
      CALL RESET ('DOT')
      CALL DASH
      CALL LEGLIN
      CALL CURVE (KNOTS,POY,N,0)
      CALL RESET ('DASH')
      CALL CHNDOT
      CALL LEGLIN
      CALL CURVE (KNOTS,PPY,N,0)
      CALL RESET ('CHNDOT')
      CALL CHNDSH
      CALL LEGLIN
      CALL CURVE (KNOTS,PCMPA,N,0)
      CALL RESET ('CHNDSH')
      CALL LEGLIN
      CALL CURVE (KNOTS,PTY,N,0)
      CALL LEGEND (IHP,5,3.7,4.25)
      CALL RLMESS ('X--PSHP$',100,0.,-PSHP)
      CALL RLMESS ('X-MAX SHP$',100,0.,SHPMM(ENGSEL))
      CALL RLMESS ('X-CRUISE$',100,VCR,0.)
      CALL BLREC (3.5,4.15,2.,1.55,1.)
      CALL RESET ('THKCRV')
      CALL DCT
      CALL GRID (2,1)
      CALL RESET ('DOT')
```

```
      CALL ENDPL (0)
C***********************************************************************
C     ** END OF DISSPLA SPECIFIC PORTION OF THE PROGRAM                *
C***********************************************************************
      WRITE (6,2310) PSHP
      WRITE(8,1410)PSHP
      GO TO 1380
1370  CONTINUE
      WRITE (6,2770)
1380  CONTINUE
C***********************************************************************
C     7.5 DETERMINE THE MAXIMUM RANGE VELOCITY                         *
C***********************************************************************
      WRITE (6,2320)
      READ (5,*) VMAXR
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,2760)
      READ (5,*) VELMAX
      CALL FRTCMS ('CLRSCRN 6')
C***********************************************************************
C     7.6 DETERMINE THE MAXIMUM ENDURANCE VELOCITY                     *
C***********************************************************************
      WRITE (6,2330)
      READ (5,*) VMAXE
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,2340)
      READ (5,*) RSHPME
      RSHRME=PSHP+RSHPME
      WFME=RSHRME*BETA
      CALL FRTCMS ('CLRSCRN 6')
C***********************************************************************
C     7.7 DETERMINE THE POWER REQUIRED AND FUEL FLOW RATE AT           *
C         SPECIFICATION CRUISE VELOCITY                                *
C***********************************************************************
      WRITE (6,2350)
      READ (5,*) RSHPC
      RSHPRC=PSHP+RSHPC
      WFCR=RSHPRC*BETA
      CALL FRTCMS ('CLRSCRN 6')
      IF (TRIP4.EQ.4.) GO TO 1390
1390  CONTINUE
C***********************************************************************
C     7.8 DETERMINE THE TOTAL FUEL REQUIREMENTS                        *
C***********************************************************************
      FW=(.05*WFN)*2.+(WFCR*RNGMAX/VCR)+.25*WFME
      GALIN=FW/6.5
      GALOUT=0.
      WRITE (6,2380) FW
```

```
      WRITE (8,2380) FW
C***********************************************************************
C     8.1 COMPUTE DESIGN GROSS AND EMPTY WEIGHT                        *
C***********************************************************************
      DWG=WGNEW+FW-FUEL
      WRITE (6,2390) DWG,REVWG
      WRITE (8,2390) DWG,WG
      SIM=1.-DWG/WG
      IF (SIM.LT..1) GO TO 1400
      WRITE (6,2420)
      WRITE (8,2420)
      WE=DWG-FW-USELOD
      FUEL=FW
      TRIP1=1.
      TRIP2=2.
      TRIP3=3.
      TRIP4=4.
      GO TO 120
1400  CONTINUE
      EXCESS=REVWG-DWG
      IF (EXCESS.LE.0.) GO TO 1430
      WRITE (6,2400) EXCESS
      READ (5,*) ANS
      CALL FRTCMS ('CLRSCRN 6')
      IF (ANS.NE.1.) GO TO 1410
      FWNEW=FW+EXCESS
      RNGNMX=(FWNEW-.05*WFN-.25*WFME-.05*WFN)*VCR/WFC
      NEWUSE=USELOD
      DWG=DWG+EXCESS
      GO TO 1440
1410  IF (ANS.NE.2.) GO TO 1420
      NEWUSE=USELOD+EXCESS
      RNGNMX=RNGMAX
      DWG=DWG+EXCESS
1420  CONTINUE
      WRITE (6,2410)
      READ (5,*) FWNEW
      NEWUSE=EXCESS-FWNEW+USELOD
      RNGNMX=(FWNEW-.05*WFN-.25*WFME-.05*WFN)*VCR/WFC
      DWG=DWG+EXCESS
      GO TO 1440
1430  RNGNMX=RNGMAX
      NEWUSE=USELOD
1440  CONTINUE
      FW=FWNEW
C***********************************************************************
C     8.2 DETERMINE BEST RATE OF CLIMB                                 *
C***********************************************************************
```

```
 1450 CONTINUE
      PAVAIL=(SHPMM(ENGSEL)-10.)/(.1*FLOAT(NENG-1)+1.03)
      WRITE (6,2460)
      READ (5,*) VVERT
      RCLIMB=VVERT
      CALL FRTCMS ('CLRSCRN 6')
      VVERT=VVERT/60.
      VFWD=VMAXE*1.151*5280./3600.
      VINEW=SQRT(DWG/(2.*RHOSL*AREAMR))
      EFPAVF=2.*EFPAFF
      VITNEW(1)=1.
      VITNEW(2)=2.*VVERT
      VITNEW(3)=VFWD**2+VVERT**2
      VITNEW(4)=0.
      VITNEW(5)=-VINEW**4
      NDEG=4
      CALL ZPCLR (VITNEW,NDEG,ZCMPLX,IER)
      VTNEW=ZCMPLX(3)
      PC=DWG*VVERT
      PC=PC/550.
      MU=VFWD/VTIP
      MUTR=VFWD/VTIPTR
      PPC=(.5*RHOSL*EFPAVF*VVERT**3)+(.5*RHOSL*EFPAFF*VFWD**3)
      PPC=PPC/550.
      POC=.125*RHOSL*CDO*SIGMA*AREAMR*VTIP**3*(1.+4.3*MU**2)
      POC=POC/550.
      PIVERT=(1./B)*DWG*VTNEW
      PIVERT=PIVERT/550.
      PTVERT=POC+PIVERT+PC+PPC
      POTR=.125*SIGTR*CDOTR*RHOSL*AREATR*(VTIPTR**3)
      POTRF=(1.+4.3*MUTR**2)*POTR
      POTRF=POTRF/550.
      PPF=.5*RHOSL*(VFWD**3)*EFPAFF
      PPF=PPF/550.
      PO=.125*SIGMA*CDO*RHOSL*AREAMR*(VTIP**3)
      POF=(1.+4.3*MU**2)*PO
      POF=POF/550.
      VI=SQRT(DWG/(2.*RHOSL*AREAMR))
      VIT=VI*SQRT((-(VFWD**2/(2.*VI**2)))
     1    +SQRT(((VFWD**2/(2.*VI**2))**2)+1.))
      PITLF=(1./B)*DWG*VIT
      PITLF=PITLF/550.
      PTF=PITLF+POF+PPF
      TTR=((PTF*550.)/(OMEGA*LTR))
      CTTR=TTR/(AREAMR*(VTIPTR**2)*RHOSL)
      BTR=1.-SQRT(2.*CTTR)/FLOAT(BLADTR)
      VITR=SQRT(TTR/(2.*RHOSL*AREATR))
      VITTR=VITR*SQRT((-(VFWD**2/(2.*VITR**2)))
```

```
1        +SQRT(((VFWD**2/(2.*VITR**2))**2)+1.))
       PITLTF=(1./B)*TTR*VITTR
       PITLTF=PITLTF/550.
       PTTRF=PITLTF+POTRF
       PTAVAL=PTTRF+PTVERT
       WRITE (6,2470) PAVAIL,PTAVAL,PIVERT
       READ (5,*) ANS
       CALL FRTCMS ('CLRSCRN 6')
       IF (ANS.EQ.1.) GO TO 1450
       VVERT=VVERT*60.
       WRITE (6,2460) RCLIMB
       WRITE (8,2480) RCLIMB
C***************************************************************************
C      8.3 COMPUTE MAXIMUM HOVER ALTITUDE, IGE                             *
C***************************************************************************
1460   CONTINUE
       WRITE (6,2500)
       READ (5,*) ALT
       CALL FRTCMS ('CLRSCRN 6')
       PALT=2116.22*(1.-CONST*ALT)**5.2561
       DELTA=PALT/2116.22
       TALT=518.688*(1.-CONST*ALT)
       THETA=TALT/518.688
       CALL FRTCMS ('CLRSCRN 6')
       RHOMH=.0023769*(1.-CONST*ALT)**4.2561
       CTH=DWG/(AREAMR*RHOMH*VTIP**2)
       BH=1.-SQRT(2.*CTH)/FLOAT(BLADES)
       PITLH=(1./BH)*(DWG**1.5/SQRT(2.*RHOMH*AREAMR))
       PPOGEH=-.1276*(H/D)**4+.708*(H/D)**3-1.4569*(H/D)**2+1.3432*(H/D)+
     1.5147
       POH=.125*SIGMA*CDO*RHOMH*AREAMR*VTIP**3
       PTH=PITLH+POH
       TTR=PTH/(OMEGA*LTR)
       VTIPTR=OMEGTR*RTR
       CTTR=TTR/(AREATR*RHOMH*VTIPTR**2)
       BTR=1.-SQRT(2.*CTTR)/FLOAT(BLADTR)
       PITLTR=(1./BTR)*(TTR**1.5/SQRT(2.*RHOMH*AREATR))
       POTR=.125*SIGTR*CDOTR*RHOMH*AREATR*(VTIPTR**3)
       PTTRH=PITLTR+POTR
       PTACH=PTH+PTTRH
       PTACH=PTACH/550.
       PAVAIL=((SHPMM(ENGSEL)-10.)/(.1*FLOAT(NENG-1)+1.03))*DELTA/SQRT(TH
     1ETA)
       WRITE (6,2490) PAVAIL,PTACH
       READ (5,*) ANS
       CALL FRTCMS ('CLRSCRN 6')
       IF (ANS.EQ.1.) GO TO 1460
       WRITE (6,2530) ALT
```

```
      WRITE (8,2530) ALT
 1470 CONTINUE
C***********************************************************************
C     8.4 COMPUTE SERVICE CEILING                                      *
C***********************************************************************
      WRITE (6,2510)
      READ (5,*) ALTSC
      CALL FRTCMS ('CLRSCRN 6')
      PALT=2116.22*(1.-CONST*ALTSC)**5.2561
      DELTA=PALT/2116.22
      TALT=518.688*(1.-CONST*ALTSC)
      THETA=TALT/518.688
      RHOSC=.0023769*(1.-CONST*ALTSC)**4.2561
      PAVAIL=((SHPN(ENGSEL)*FLOAT(NENG)-10.)/(.1*FLOAT(NENG-1)+1.03))*DE
     1LTA/SQRT(THETA)
      VVERT=100./60.
      VFWD=VMAXE*1.151*5280./3600.
      VINEW=SQRT(DWG/(2.*RHOSC*AREAMR))
      VITNEW(1)=1.
      VITNEW(2)=2.*VVERT
      VITNEW(3)=VFWD**2+VVERT**2
      VITNEW(4)=0.
      VITNEW(5)=-VINEW**4
      CALL ZPCLR (VITNEW,NDEG,ZCMPLX,IER)
      VTNEW=ZCMPLX(3)
      PC=DWG*VVERT
      PC=PC/550.
      PPC=(.5*RHOSC*EFPAVF*VVERT**3)+(.5*RHOSC*EFPAFF*VFWD**3)
      PPC=PPC/550.
      POC=.125*RHOSC*CDO*SIGMA*AREAMR*VTIP**3
      POC=POC/550.
      PIVERT=(1./8)*DWG*VTNEW
      PIVERT=PIVERT/550.
      PTVERT=POC+PIVERT+PC+PPC
      MUTR=VFWD/VTIPTR
      POTR=.125*SIGTR*CDOTR*RHOSC*AREATR*(VTIPTR**3)
      POTRF=(1.+4.3*MUTR**2)*POTR
      POTRF=POTRF/550.
      PPF=.5*RHOSC*(VFWD**3)*EFPAFF
      PPF=PPF/550.
      MU=VFWD/VTIP
      PO=.125*SIGMA*CDO*RHOSC*AREAMR*(VTIP**3)
      POF=(1.+4.3*MU**2)*PO
      POF=POF/550.
      VI=SQRT(DWG/(2.*RHOSC*AREAMR))
      VIT=VI*SQRT((-(VFWD**2/(2.*VI**2)))
     1            +SQRT(((VFWD**2/(2.*VI**2))**2)+1.))
      PITLF=(1./8)*DWG*VIT
```

```
      PITLF=FITLF/550.
      PTF=PITLF+PCF+PPF
      TTR=((PTF*550.)/(OMEGA*LTR))
      CTTR=TTR/(AREATR*(VTIPTR**2)*RHOSC)
      BTR=1.-SQRT(2.*CTTR)/FLOAT(BLADTR)
      VITR=SQRT(TTR/(2.*RHOSC*AREATR))
      VITTR=VITR*SQRT((-(VFWD**2/(2.*VITR**2)))
     1               +SQRT(((VFWD**2/(2.*VITR**2))**2)+1.))
      PITLTF=(1./B)*TTR*VITTR
      PITLTF=PITLTF/550.
      PTTRF=PITLTF+POTRF
      PTAVAL=PTTRF+PTVERT
      WRITE (6,2540) PAVAIL,PTAVAL
      READ (5,*) ANS
      CALL FRTCMS ('CLRSCRN 6')
      IF (ANS.EQ.1.) GO TO 1470
      WRITE (6,2520) ALTSC
      WRITE (8,2520) ALTSC
C*********************************************************************
C     9.1 MAKE FINAL CHECK FOR SPECIFICATION COMPLIANCE              *
C*********************************************************************
      WRITE (6,2550) CREW,PEOPLE,SPCLOD,NEWUSE,SC,ALTSC,HOVIGE,ALT,VCR,V
     1MAXR,MAXV,VELMAX,VMAXE,VMAXR,RBS,RNGMAX,RNGNMX,MAXRC,RCLIMB,NENG
      WRITE (8,2550) CREW,PEOPLE,SPCLOD,NEWUSE,SC,ALTSC,HOVIGE,ALT,VCR,V
     1MAXR,MAXV,VELMAX,VMAXE,VMAXR,RBS,RNGMAX,RNGNMX,MAXRC,RCLIMB,NENG
      IF (ENGSEL.NE.1.) GO TO 1480
      WRITE (6,2560)
      WRITE (8,2560)
      GO TO 1530
 1480 IF (ENGSEL.NE.2.) GO TO 1490
      WRITE (6,2570)
      WRITE (8,2570)
      GO TO 1530
 1490 IF (ENGSEL.NE.3.) GO TO 1500
      WRITE (6,2580)
      WRITE (8,2580)
      GO TO 1530
 1500 IF (ENGSEL.NE.4.) GO TO 1510
      WRITE (6,2590)
      WRITE (8,2590)
      GO TO 1530
 1510 IF (ENGSEL.NE.5.) GO TO 1520
      WRITE (6,2600)
      WRITE (8,2600)
      GO TO 1530
 1520 CONTINUE
      WRITE (6,2610)
      WRITE (8,2610)
```

```
      GO TO 1530
 1530 CONTINUE
      WRITE (6,2620)  SHPMM(ENGSEL),GWSPEC,DWG,WE,GALIN,GALOJT,CHORD,RSPE
     1C,R,BLADES,CDO,OMEGA,SIGMA,CHORDT,RTR,BLADTR
      WRITE (8,2620)  SHPMM(ENGSEL),GWSPEC,DWG,WE,GALIN,GALOUT,CHORD,RSPE
     1C,R,BLADES,CDO,OMEGA,SIGMA,CHORDT,RTR,BLADTR
      WRITE (6,2630)  CDOTR,OMEGTR,SIGTR,STT,FSLTS,FSLT,EFPAFF,EFPAVF
      WRITE (8,2630)  CDOTR,OMEGTR,SIGTR,STT,FSLTS,FSLT,EFPAFF,EFPAVF
C***********************************************************************
C     10.1  BASES FOR COST ESTIMATING RELATIONSHIPS                    *
C***********************************************************************
      Q=100.
      C1=-12538.+101.*W1*(Q**(-.074))*IR
      C2A=102.*W2A*(Q**(-.074))*IR
      C2B=759.*(W2B**.848)*(Q**(-.286))*IR
      C3=860.*(W3**.848)*(Q**(-.286))*IR
      IF (LG.NE.2.) GO TO 1540
      C4=85.*W4*(C**(-.2176))*IR
      GO TO 1550
 1540 CONTINUE
      C4=C3*W4/W3*IR
 1550 CONTINUE
      C5=893.*(W5**.848)*(Q**(-.286))*IR
      C6A=ICM(ENGSEL)*IR*1000.
      C6B=19946.+83.*W6B*(Q**(-.074))*IR
      C6C=201.*W6C*(Q**(-.0896))*IR
      C7=156.*W7*(Q**(-.0896))*IR
      C8=243.*W8*(Q**(-.0896))*IR
      C9=125.*W9*(Q**(-.0896))*IR
      C10=91.*W10*(Q**(-.0896))*IR
      C11=143.*W11*(Q**(-.0896))*IR
      C12=6847.+125.*W12*(Q**(-.0896))*IR
      C13=69.*W13*(Q**(-.0896))*IR
      C14=213.*W14*(Q**(-.0896))*IR
      C15=C3*W15/W3*IR
      TOTALC=C1+C2A+C2B+C3+C4+C5+C6A+C6B+C6C+C7+C8+C9+C10+C11+C12+C13+C1
     14+C15
      WRITE (6,2810)  C1,C2A,C2B,C3,C4,C5,C6A,C6B,C6C,C7,C8,C9,C10,C11,C1
     12,C13,C14,C15,TOTALC
      WRITE (8,2810)  C1,C2A,C2B,C3,C4,C5,C6A,C6B,C6C,C7,C8,C9,C10,C11,C1
     12,C13,C14,C15,TOTALC
      CALL DCNEPL
      STOP
C***********************************************************************
 1560 FORMAT (////39H WHAT TYPE OF MACHINE ARE YOU NOW USING,/,10X,22H1.
     1  TEK618/DUAL SCREEN,/,10X,12H2.   IBM 3278)
 1570 FORMAT (45H ENTER THE SPECIFICATION MAXIMUM GROSS WEIGHT)
 1580 FORMAT (47H ENTER THE MANUFACTURERS ESTIMATED EMPTY WEIGHT)
```

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1590  FORMAT (55H ENTER THE GROSS WEIGHT THAT YOU WANT FOR THE FIRST 80%
     1,9H ESTIMATE)
1600  FORMAT (30H GROSS WEIGHT ESTIMATE          =,F8.2)
1610  FORMAT (54H ENTER THE VALUE OF THE DISC LOADING FOR THE ESTIMATED,
     1/,16H GROSS WEIGHT OF,F9.2,4H LBS)
1620  FORMAT (56H ENTER THE SPECIFICATION MAXIMUM FORWARD VELOCITY(KNOTS
     1))
1630  FORMAT (28H THE ADVANCE RATIO (MU) IS =,F6.4,/)
1640  FORMAT (52H ENTER THE BLADE LOADING FOR THE GIVEN ADVANCE RATIO)
1650  FORMAT (52H ENTER THE NUMBER OF MAIN ROTOR BLADES THAT YOU WANT)
1660  FORMAT (30H1GROSS WEIGHT (LBS)              =,F10.2,/,30H EMPTY WEIGHT
     1 (LBS)          =,F10.2,/,30H SONIC SPEED (FPS)           =,F10.2,
     2/,30H MAXIMUM TIP VELOCITY (FPS)  =,F10.2,/,30H DISK LOADING
     3          =,F10.2,/,30H ROTOR RADIUS (FT)            =,F10.2,/,30H
     4ROTATIONAL VELOCITY (RPS)    =,F10.2,/,30H TIP VELOCITY (FPS)
     5    =,F10.2,/,30H COEFFICIENT OF THRUST       =,F14.6,/,30H ADVANC
     6E RATIO (MU)           =,F12.4,/,30H BLADE LOADING              =,
     7F12.4,/,30H SOLIDITY                        =,F15.7,/,30H NUMBER OF MA
     8IN ROTOR BLADES =,5X,I2,/,30H CHORD MAIN ROTOR BLADE (FT) =,F14.6)
1670  FORMAT (10X,30H       THE ASPECT RATIO IS    =,F11.3,/,10X,30H
     1 THE ROTATIONAL SPEED IS=,F11.3)
1680  FORMAT (10X,39H WHAT ROTATIONAL SPEED DO YOU WANT NOW?)
1690  FORMAT (55H WHAT IS THE COEFFICIENT OF LIFT WITH RESPECT TO ALPHA?
     1,6H(/DEG))
1700  FORMAT (43H WHAT IS THE ZERO LIFT COEFFICIENT OF DRAG?)
1710  FORMAT (30H1GROSS WEIGHT (LBS)              =,F10.2,/,30H EMPTY WEIGHT
     1 (LBS)          =,F10.2,/,30H SONIC SPEED (FPS)           =,F10.2,
     2/,30H MAXIMUM TIP VELOCITY (FPS)  =,F10.2,/,30H DISK LOADING (LBS/
     3SF)        =,F10.2,/,30H ROTOR RADIUS (FT)            =,F10.2,/,30H
     4ROTATIONAL VELOCITY (RPS)    =,F10.2,/,30H TIP VELOCITY (FPS)
     5    =,F10.2,/,30H COEFFICIENT OF THRUST       =,F14.6,/,30H ADVANC
     6E RATIO (MU)           =,F12.4,/,30H BLADE LOADING              =,
     7F12.4,/,30H SOLIDITY                        =,F15.7,/,30H NUMBER OF MA
     8IN ROTOR BLADES =,5X,I2,/,30H CHORD MAIN ROTOR BLADE (FT) =,F11.3,
     9/,30H ASPECT RATIO OF MAIN ROTOR  =,F10.2,/,30H COEFF OF LIFT (AVG
     $)          =,F12.4,/,30H COEFF OF LIFT W/R ALPHA     =,F12.4,/,30H
     $COEFF OF DRAG @ 0 LIFT       =,F12.4)
1720  FORMAT (///35H ENTER THE AMOUNT OF FUEL IN POUNDS)
1730  FORMAT (46H ENTER THE USEFUL LOAD IN POUNDS THAT YOU WANT)
1740  FORMAT (47H ENTER THE NUMBER OF PEOPLE YOU ARE PLANNING ON)
1750  FORMAT (37H ENTER THE NUMBER OF ENGINES YOU WANT)
1760  FORMAT (30H1TIP LOSS FACTOR                 =,F16.7,/,30H POWER (INDUC
     1ED)(HP)        =,F10.1,/,30H POWER (PROFILE)(HP)          =,F10.1,
     2/,30H POWER (TOTAL)(HP)            =,F10.1,/,30H EMPTY WEIGHT (LBS)
     3          =,F11.2,/,30H FUEL WEIGHT (LBS)            =,F11.2,/,30H
     4NUMBER OF PEOPLE               =,6X,I2,/,30H USEFUL LOAD (LBS)
     5    =,F11.2,/,30H NUMBER OF ENGINES           =,6X,I2,/,30H ESTIMA
     6TED GROSS WEIGHT(LBS) =,F11.2,/,30H SOLIDITY                    =,
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      7F16.7,/,30H ROTOR RADIUS (FT)               =,F12.3,/,30H HOVER POWER
      8(HP)              =,F10.1,/,30H ROTOR WEIGHT(LBS)              =,F11.2,
      9/,30H TAIL: ROTOR (LBS)                =,F11.2,/,30H       STRUCTURE (L
      $BS)        =,F11.2,/,30H BODY (LBS)                      =,F11.2,/,30H
      $LANDING GEAR (LBS)           =,F11.2)
 1770  FORMAT (30H NACELLE (LBS)                  =,F11.2,/,30H PROPULSION:
      1ENGINE (LBS)     =,F11.2,/,30H                DRIVE (LBS)      =,F11.2,
      2/,30H                FUEL TANKS (LBS)=,F11.2,/,30H FLIGHT CONTROLS (L
      3BS)        =,F11.2,/,30H AUXILLARY POWER (LBS)            =,F11.2,/,30H
      4INSTRUMENTS (LBS)              =,F11.2,/,30H HYDRAULICS (LBS)
      5    =,F11.2,/,30H ELECTRICAL (LBS)                =,F11.2,/,30H AVIONI
      6CS (LBS)              =,F11.2,/,30H FURNISHINGS (LBS)               =,
      7F11.2,/,30H AIR AND ICE (LBS)              =,F11.2,/,30H LOAD AND HAN
      8DLING (LBS)      =,F11.2,///,30H REVISED EMPTY WEIGHT (LBS)  =,F11.
      92,/,30H REVISED GROSS WEIGHT (LBS)  =,F11.2)
 1780  FORMAT (////30H FIGURE OF MERIT (%)            =,F7.3)
 1790  FORMAT (/46H LOOK AT YOUR FIGURE OF MERIT, IF NOT 70<M<80%,/,10X,5
      15H THEN  1. RECALCULATE THE ROTOR RADIUS WITH THE NEW DL,/,17X,20
      2H2.  CHANGE THE CHORD,/,17X,11H3.  CHANGE ,23HTHE ROTATIONAL VELOC
      3ITY,/,17X,15H4.  CONTINUE ON)
 1800  FORMAT (24H THE OLD GRCSS WEIGHT IS,F11.2,/,/,40H DO YOU WANT TO C
      1HANGE THE DISC LOADING?,/,10X,7H1.  YES,/,10X,6H2.  NO)
 1810  FORMAT (56H ENTER A NEW DISK LOADING USING THE REVISED GROSS WEIGH
      1T)
 1820  FORMAT (37H ENTER THE HEIGHT OF THE ROTCR SYSTEM)
 1830  FORMAT (50H USE THE LATEST ESTIMATE OF GROSS WEIGHT AND ENTER,/,34
      1H THE ECUIVALENT FLAT PLATE LOADING)
 1840  FORMAT (///43H1                      MAIN ROTOR POWER PROFILE,/,35H
      1                          @ SSL,/,55H
      2   POWER________________________/,58H AIRSPEED  TIP     INDUCED----PROF
      3ILE     PARASITE----TOTAL,7,58H (KNOTS)    MACH      (SHP)       (SHP)
      4      (SHP)        (SHP))
 1850  FORMAT (2X,F7.2,1X,F5.2,1X,F9.2,2X,F9.2,2X,F9.2,2X,F9.2)
 1860  FORMAT (/////43H1                         MAIN ROTOR POWER PROFILE,/,49H
      1       AT SPECIFICATION ALTITUDE AND TEMPERATURE,/,55H
      2                   POWER________________/,58H AIRSPEED  TIP
      3 INDUCED----PROFILE    PARASITE----TOTAL,7,58H (KNOTS)    MACH
      4(SHP)       (SHP)       (SHP)       (SHP))
 1870  FORMAT (34H ENTER THE NEW CHORD THAT YOU WANT)
 1880  FORMAT (////,29H        TAIL ROTOR RADIUS (FT)=,F8.3)
 1890  FORMAT (5X,24H TAIL ROTOR SPEED (RPS)=,F8.3)
 1900  FORMAT (5X,24H TAIL ROTOR CDO        =,3X,F9.7)
 1910  FORMAT (5X,//34H ENTER NUMBER OF TAIL ROTOR BLADES,//,35H        2
      1    FOR A LIGHT HELICOPTER,/,36H          3-4   FOR A MEDIUM HELICOPT
      2ER,/,35H         4-7    FOR A HEAVY HELICCPTER)
 1920  FORMAT (43H ENTER ASPECT RATIO OF TAIL ROTOR (4.5-8.0))
 1930  FORMAT (///39H1                  TAIL ROTOR POWER PROFILE,/,27H
      1                @ SSL,/,48H             _____________POWER__________
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     2________/,47H AIRSPEED  TIP      INDUCED     PROFILE      TOTAL,/,47H
     3 (KNOTS)    MACH      (SHP)      (SHP)      (SHP))
1940  FORMAT (///39H1                TAIL ROTOR POWER PROFILE,/,47H      A
     1T SPECIFICATION ALTITUDE AND TEMPERATURE,/,48H
     2    POWER_____________________/,47H AIRSPEED  TIP     INDUCED----PRO
     3FILE      TOTAL,7,47H (KNOTS)    MACH      (SHP)      (SHP)      (SHP
     4))
1950  FORMAT (2X,F7.2,1X,F5.2,1X,F9.2,2X,F9.2,2X,F9.2)
1960  FORMAT (/////42H TOTAL POWER FOR THE AIRCRAFT TO HOVER IS=,F10.2)
1970  FORMAT (///42H1                TOTAL ROTOR POWER PROFILE,/,32H
     1                    @ SSL,/,8X,55H                ---------------POWER_
     2                     _/,57H AIRSPEED    INDUCED----PROFILE
     3PARASITE----COMP---------,6H TOTAL,/,57H (KNOTS)       (SHP)       (SHP
     4)        (SHP)      (SHP)      ,6H (SHP))
1980  FORMAT (2X,F7.2,1X,F9.2,2X,F9.2,2X,F9.2,2X,F9.2,2X,F9.2)
1990  FORMAT (///42H1                TOTAL ROTOR POWER PROFILE,/,48H
     1   AT SPECIFICATION ALTITUDE AND TEMPERATURE,/,8X,55H
     2-------PCWER_______----------------------/,57H AIRSPEED    INDUCE
     3D    PROFILE    PARASITE-----COMP--------,6H TOTAL,/,57H (KNOTS)
     4 (SHP)       (SHP)       (SHP)       (SHP)       ,6H (SHP))
2000  FORMAT (36H THE REQUIRED SHAFT HORSEPOWER IS  =,F10.2)
2010  FORMAT (///4H FOR,I2,41H ENGINE(S), THE REQUIRED SHAFT HORSEPOWER,
     14H IS=,F10.2)
2020  FORMAT (28H YOU PRESENTLY HAVE SELECTED,1X,I2,1X,7HENGINES)
2030  FORMAT (53H DO YOU WANT TO CHANGE THE NUMBER OF ENGINES SELECTED,/
     1,15X,6H1. YES,/,15X,5H2. NO)
2040  FORMAT (42H ENTER THE NUMBER OF ENGINES THAT YOU WANT)
2050  FORMAT (54H ENTER THE NUMBER OF AVERAGE FLIGHT HOURS PER YEAR PER,
     19H AIRFRAME)
2060  FORMAT (52H ENTER THE NUMBER OF AVERAGE FLIGHT HOURS PER FLIGHT)
2070  FORMAT (46H ENTER THE AVERAGE AIRFRAME SERVICE LIFE YEARS)
2080  FORMAT (51H1                      ENGINE SELECTION CRITERIA,/,2
     14X,47H        ------------- 1 ENGINE ----------------,/,24X,46H
     2 A        B        C        D        E        F)
2090  FORMAT (//51H                       ENGINE SELECTION CRITERIA,/
     1,24X,15H      ---------,I2,26H ENGINE(S) --------------,/,24X,46H
     2     A        B        C        D        E        F)
2100  FORMAT (23H POWERPLANT WEIGHT(LB):,6F8.1)
2110  FORMAT (23H LIFE-CYCLE COST($10M):,6F8.2)
2120  FORMAT (23H ENGINE LIFE(HRS):     ,6F8.1)
2130  FORMAT (23H NUMBER OF REPLACEMENT:,6F8.1)
2140  FORMAT (23H R AND D COSTS($K):    ,6F8.1)
2150  FORMAT (23H INTIAL COSTS($K):     ,6F8.1)
2160  FORMAT (23H YEAR MAINT COST($K):  ,6F8.2)
2170  FORMAT (23H YEAR OPERATE COST($K):,6F8.2)
2180  FORMAT (23H REPLACEMENT COST($K): ,6F8.2)
2190  FORMAT (23H SALVAGE VALUE($K):    ,6F8.2)
2200  FORMAT (23H AVAILABILITY(ENG):    ,6F8.4)
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2210  FORMAT (23H RELIABILITY(ENG):       ,6F8.4)
2220  FORMAT (23H MAINTAINABILITY(ENG):  ,6F8.3)
2230  FORMAT (23H PERFORMANCE(SHP-MIL):  ,6F8.1/)
2240  FORMAT (49H SELECT: (1.A)--(2.B)--(3.C)--(4.D)--(5.E)--(6.F))
2250  FORMAT (//51H1  ----------------FUEL FLOW RATES----------------,/
     1,50H  MILITARY POWER     NORMAL POWER     CRUISE POWER)
2260  FORMAT (3X,F10.2,7X,F10.2,7X,F10.2///////)
2270  FORMAT (30H THE CURRENT CHORD IS           =,F8.2)
2280  FORMAT (30H TEMPERATURE (R)                =,F10.3,/,30H PRESSURE (PS
     1F)             =,F10.3,/,30H ALPHA AT SSL                 =,F10.3,
     2/,30H THETA AT SPEC ALTITUDE      =,F10.3,/,30H DELTA AT SPEC ALTI
     3TUDE       =,F10.3,/,26H ZERO HORSEPCWER INTERCEPT,/,30H AT SPEC AL
     4TITUDE               =,F10.3)
2290  FORMAT (///43H THE ZERO HORSEPOWER INCREMENT AT ALTITJDE=,F10.3)
2300  FORMAT (//19H OLD GROSS WEIGHT =,F10.2,/,19H NEW GROSS WEIGHT =,F1
     10.2)
2310  FORMAT (///32H THE PHANTOM HORSEPOWER IS    =  ,F10.2)
2320  FORMAT (41H ENTER THE MAX RANGE VELOCITY FRCM GRAPHS)
2330  FORMAT (49H ENTER THE MAX ENDURANCE VELOCITY FROM THE GRAPHS)
2340  FORMAT (52H ENTER THE MAX REQUIRED HORSEPOWER FOR MAX ENDURANCE)
2350  FORMAT (49H ENTER THE REQUIRED HORSEPOWER AT CRUISE VELOCITY)
2360  FORMAT (49H ENTER THE MAX RANGE FROM THE SPECIFICATIONS (NM))
2370  FORMAT (35H ENTER THE CRUISE VELOCITY IN KNCTS)
2380  FORMAT (////23H THE FUEL WEIGHT IS   =,F10.2,3HLBS)
2390  FORMAT (32H THE DESIGN GROSS WEIGHT IS    =,F10.2,/,32H THE ESTIMA
     1TED GROSS WEIGHT IS =,F10.2)
2400  FORMAT (30H ADVANTAGEOUS EXCESS WEIGHT IS,F10.1,/,41H WHICH PARAME
     1TER DO YOU WANT TO INCREASE?,/,10X,18H1. FUEL CAPABILITY,/,10X,14H
     22. USEFUL LCAD,/,10X,7H3. BOTH)
2410  FORMAT (24H ENTER THE NEW FUEL LOAD)
2420  FORMAT (54H YOU ARE OVER THE ESTIMATED GROSS WEIGHT AND THEREFORE,
     1/,15H MLST FEITERATE)
2430  FORMAT (48H1NOTE THE VELOCITY THAT HAS THE STALL ANGLE LESS,/,31H
     1THAN OR EQUAL TO 12.5 DEGREES ,//,21H  VELOCITY       ANGLE,/,21H
     2 (KNOTS)        (DEG))
2440  FORMAT (1X,F9.2,7X,F6.1)
2450  FORMAT (36H THE REQUIRED SHAFT HORSEPOWER IS  =,F10.2)
2460  FORMAT (///53H COMPUTATION OF THE BEST RATE OF CLIMB, ENTER A GUES
     1S,/,45H FOR THE VERTICAL RATE OF CLIMB (FEET/MINUTE))
2470  FORMAT (37H THE POWER AVAILABLE IS                =,F10.2,/,37H THE T
     1OTAL POWER CF THE AIRCRAFT IS =,F10.2,/,37H THE PROFILE POWER IS
     2              =,F10.2,/,53H____________________________________
     3              ,/,49H THE TOTAL POWER SHOULD EQUAL THE POWER AVAILAB
     4LE,7,36F ,IF NOT, ENTER A 1, ELSE, ENTER A 2)
2480  FORMAT (////26H THE BEST RATE OF CLIMB IS,F10.2,16H FEET PER MINUT
     1E)
2490  FORMAT (37H THE POWER AVAILABLE IS                =,F10.2,/,37H THE T
     1OTAL PCWER CF THE AIRCRAFT IS =,F10.2,/,53H________________________
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     2_______________________________,/,49H THE TOTAL POWER SHOULD EQUAL
     3THE POWER AVAILABLE,/,35H IF NOT, ENTER A 1, ELSE, ENTER A 2)
2500  FORMAT (///53H COMPUTATION OF THE MAX HOVER ALT (IGE),ENTER A GUES
     1S,/,25H FOR THE ALTITUDE IN FEET)
2510  FORMAT (///51H COMPUTATION FOR THE SERVICE CEILING, ENTER A GUESS,
     1/,25H FOR THE ALTITUDE IN FEET)
2520  FORMAT (///34H THE SERVICE CEILING ALTITUDE IS =,F10.2)
2530  FORMAT (///32H THE HOVER CEILING ALTITUDE IS =,F10.2)
2540  FORMAT (37H THE POWER AVAILABLE IS              =,F10.2,/,37H THE T
     1OTAL PCWER CF THE AIRCRAFT IS =,F10.2,/,53H______________________
     2_______________________________,/,49H THE TOTAL POWER SHCULD EQUAL
     3THE POWER AVAILABLE,/,35H IF NOT, ENTER A 1, ELSE, ENTER A 2)
2550  FORMAT (43H1                       HELICOPTER DESIGN,/,31X,6HAE4
     1306,/,27X,13HFINAL SUMMARY,//,28X,11HPERFORMANCE,//,40X,30HSPECIFI
     2CATION          DESIGN,/,41H CREW................................
     3....,8X,I2,18X,I2,/,41H INTERNAL LOAD(LBS)......................,F
     410.1,10X,F1C.1,/,41H SERVICE CEILING(FT).....................,F10.
     51,10X,F10.1,/,41H HOVER IGE (FT)..........................,F10.1,1
     60X,F10.1,/,41H VELOCITY (KTS) CRUISE...................,F10.1,10X,
     7F10.1,/,41H              MAXIMUM....................,F10.1,10X,F10
     8.1,/,41H              MAX ENDURANCE.............,20X,F10.1,/,41H
     9              MAX RANGE................,20X,F10.1,/,41H
     $      RETREATING BLADE STALL...,20X,F10.1,/,41H MAXIMJM RANGE (NMI
     $)......................,F10.1,10X,F10.1 ,/,41H MAXIMUM RATE OF CLIMB
     $ (FT/MIN)..........,F10.1,10X,F10.1,/,41H ENGINE - NUMBER.........
     $.................,28X,I2)
2560  FORMAT (10X,31HTYPE...........................,29X,1HA)
2570  FORMAT (10X,31HTYPE...........................,29X,1HB)
2580  FORMAT (10X,31HTYPE...........................,29X,1HC)
2590  FORMAT (10X,31HTYPE...........................,29X,1HD)
2600  FORMAT (10X,31HTYPE...........................,29X,1HE)
2610  FORMAT (10X,31HTYPE...........................,29X,1HF)
2620  FORMAT (10X,31HSHP (SSL) MILITARY.............,20X,F10.1,//,29X,8H
     1GEOMETRY,//,41H WEIGHT (LBS) - MAX GROSS................,F10.1,10X
     2,F10.1,/,41H               EMPTY.....................,20X,F10.1,/,
     341H FUEL CAFACITY (GAL) -INTERNAL...........,20X,F10.1,/,41H
     4                EXTERNAL............,20X,F10.1,/,41H MAIN ROTOR - C
     5HORD (FT).................,20X,F10.2,/,41H             RADIUS (FT
     6)................,F10.2,10X,F10.2,/,41H              NUMBER OF BLA
     7DES............,28X,I2,/,41H                  DRAG COEFFICIENT.........
     8..,20X,F10.4,/,41H              ROTATIONAL VELOCITY........,20X,F1
     90.2,/,41H              SOLIDITY...................,20X,F10.6,/,41H
     $ TAIL RCTOR - CHORD (FT)..................,20X,F10.2,/,41H
     $    RADIUS (FT)..................,20X,F10.2,/,41H             NUMB
     $ER BLADES................,28X,I2)
2630  FORMAT (14X,27HDRAG COEFFICIENT............,20X,F10.4,/,41H
     1      RCTATIONAL VELOCITY.........,20X,F10.2,/,41H              SOL
     2IDITY.....................,20X,F10.6,/,41H VERTICAL TAIL AREA (FT)..
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     3................,20X,F10.2,/,41H FUSELAGE LENGTH (FT)...............
     4.......,F10.2,10X,F10.2,/,41H EQUIVALENT FLAT PLAGE AREA (FT) FORWA
     5RD ,20X,F10.2,/,41H                                      VERTICAL,20X,F
     610.2)
2640  FORMAT (50H ENTER THE SPECIFICATION PRESSURE ALTITUDE IN FEET)
2650  FORMAT (43H ENTER THE SPECIFICATION TEMPERATURE IN (F))
2660  FORMAT (53H FROM THE SPECIFICATIONS SHEET, WHAT IS THE NUMBER OF,6
     1H CREW?)
2670  FORMAT (51H FROM THE SPECIFICATIONS SHEET, WHAT IS THE SERVICE,9H
     1CEILING?)
2680  FORMAT (55H FROM THE SPECIFICATIONS SHEET, WHAT IS THE HOVER (IGE)
     1,9H CEILING?)
2690  FORMAT (51H FROM THE SPECIFICATIONS SHEET, WHAT IS THE MAXIMUM,14H
     1 ROTOR RADIUS?)
2700  FORMAT (51H FROM THE SPECIFICATIONS SHEET, WHAT IS THE MAXIMUM,17H
     1 FUSELAGE LENGTH?)
2710  FORMAT (47H ENTER TYPE OF HELICOPTER FOR WEIGHT ESTIMATION,/,15X,8
     1H1. LIGHT,/,15X,9H2. MEDIUM,/,15X,8H3. HEAVY)
2720  FORMAT (52H ENTER THE MAXIMUM RATE OF CLIMB FROM SPECIFICATIONS)
2730  FORMAT (40H WHICH TYPE HELICOPTER ARE YOU DESIGNING,/,10X,7H1.LIGH
     1T,/,10X,8H2.MEDIUM,/,10X,7H3.HEAVY)
2740  FORMAT (49H YOU HAVE NOT CONVERGED TO WITH 10% OF THE WEIGHT,/,29H
     1 THEREFORE YOU MUST REITERATE)
2750  FORMAT (36H ENTER THE SPECIFICATION USEFUL LOAD)
2760  FORMAT (44H ENTER THE MAXIMUM POSSIBLE FORWARD VELOCITY)
2770  FORMAT (36H HERE IS THE TOTAL POWER VS. FORWARD,16H VELOCITY TABLE
     1,,/,16H NOW GRAPH A FEW,39H POINTS AND EXTRAPOLATE THE NEEDED DATA
     2)
2780  FORMAT (35H ENTER TYPE OF LANDING GEAR DESIRED,//,10X,10H1.  WHEEL
     1S,/,10X,9H2.  SKIDS)
2790  FORMAT (32H WHAT TYPE OF GEAR DO YOU DESIRE,//,10X,9H1.  FIXED,/,1
     10X,15H2.  RETRACTABLE)
2800  FORMAT (33H ENTER THE NUMBER OF LANDING GEAR)
2810  FORMAT (55H1COST ANALYSIS PER VEHICLE (IN DOLLARS FOR 100 A/C RUN)
     1,/,5X,30H ROTOR                        =,F11.2,/,5X,30H TAIL: ROTOR
     2               =,F11.2,/,5X,30H        STRUCTURE              =,F1
     31.2,/,5X,30H BODY                        =,F11.2,/,5X,30H LANDING
     4GEAR               =,F11.2,/,5X,30H NACELLE                         =
     5,F11.2,/,5X,30H PROPULSION: ENGINE          =,F11.2,/,5X,30H
     6        DRIVE            =,F11.2,/,5X,30H                FUEL TANKS
     7  =,F11.2,/,5X,30H FLIGHT CONTROLS             =,F11.2,/,5X,30H AU
     8XILLARY POWER            =,F11.2,/,5X,30H INSTRUMENTS
     9    =,F11.2,/,5X,30H HYDRAULICS                =,F11.2,/,5X,30H
     $ ELECTRICAL                       =,F11.2,/,5X,30H AVIONICS
     $         =,F11.2,/,5X,30H FURNISHINGS                  =,F11.2,/,5X,
     $30H AIR AND ICE                  =,F11.2,/,5X,30H LOAD AND HANDLING
     $            =,F11.2,///,5X,30H TOTAL COST PER VEHICLE      =,F11.2)
2820  FORMAT (33H ENTER THE INFLATION RATE DOLLARS)
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2830  FORMAT (/27H          DYNAMIC PARAMETERS,/,38H     A11..............
     1..................,F10.6/,38H     A12..............................
     2,F10.6/,38H     A13.............................,F10.6/,38H     A
     314............................,F10.6/,38H     T1.................
     4..................,F10.6/,38H     T2............................,F
     510.6/,38H     T3..............................,F10.6/,38H     T4.
     6..............................,F10.6/,38H     INFLOW RATIO (LAMBDA
     7)..............,F10.6)
2840  FORMAT (/,5X,37HINBOARD STALL CORRECTION FACTOR......,F16.7//,5X,3
     17HSTALL POWER COEFFICIENT...............,F14.7)
2850  FORMAT (/,5X,28HANGLE OF ATTACK CALCULATIONS//,5X,35HLONGITUDINAL
     1CYCLIC ANGLE(DEG).....,F10.6/,5X,35HLONGITUDINAL COLLECTIVE ANGLE(
     2DEG).,F10.6/,5X,35HALPHA(90) (DEG)....................,F10.6/,5X,3
     35HALPHA(270) (DEG)...................,F10.6)
2860  FORMAT (/10X,24HSTALL POWER CALCULATIONS//,5X,35HRT...............
     1...................,F12.6)
2870  FORMAT (/10X,23HHIGH SPEED MACH EFFECTS//,5X,34HADVANCING BLADE TI
     1P MACH NUMBER...,F12.6/,5X,34HCRITICAL MACH NUMBER...............,F
     212.6/,5X,34HDRAG DIVERGENCE MACH NUMBER.......,F12.6/,5X,35HCOMPRE
     3SSIBILITY PCWER COEFF........,F12.6///,58H     ********************
     4*********************************/,/33H          MAIN ROTOR POWER R
     5EQUIRED/,58H     ******************************************************
     6****//,22H     INDUCED POWER = ,6X,F12.2/,22H     PROFILE POWER
     7= ,6X,F12.2/,23H     PARASITE POWER = ,5X,F12.2/,29H     COMPRES
     8IBILITY POWER = ,F12.2/,20H     STALL POWER = ,9X,F12.2//,27H
     9  HIGH SPEEC EFFECTS = ,F12.2/)
2880  FORMAT (54H1     ************************************************/
     1,10X,31HFORWARD VELOCITY IN KNOTS    =   ,F7.2/,54H     ************
     2*************************************)
2890  FORMAT (/5X,44HTIP MACH NUMBER GREATER THAN OR EQUAL TO 1.0/)
2900  FORMAT (/5X,29HDISK PLANE ANGLE OF ATTACK = ,F10.6/)
2910  FORMAT (38H     COEFFICIENT OF THRUST............ ,F12.6/,38H     DI
     1SC AREA.......................... ,F12.6/,38H     SOLIDITY..........
     2............. ,F12.6/,38H     TIP-LOSS FACTCR.................... ,F
     312.6/,38H     GROUND EFFECT RATIO............... ,F12.6//)
2920  FORMAT (38H1     RADIUS.......................... ,F12.6/,38H     MA
     1IN ROTOR CHCRD................... ,F12.6/,38H     NUMBER OF MAIN ROTO
     2R BLADES...... ,F12.6/,38H     AICRAFT GROSS WEIGHT............ ,F
     312.6/,38H     ROTOR TIP VELOCITY............... ,F12.6/,38H     HORI
     4ZONTAL FLAT PLATE AREA....... ,F12.6/,38H     NUMBER OF ENGINES IN
     5HELICOPTER.. ,F12.6//,38H     MAIN ROTOR HEIGHT ABOVE GROUND... ,F1
     62.6/,35H     AIR DENSITY (RHO)............. ,F12.6/,38H     SONIC VE
     7LOCITY..................... ,F12.6/,38H     BLADE GEOMETRIC TWIST....
     8......... ,F12.6//,38H     MAXIMUM 2-D LIFT CCEFFICIENT..... ,F12.6/
     9,38H     2-D STATIC STALL ANGLE (AMAX).... ,F12.7/,38H     LIFT CURV
     $E SLOPE (/RAD)........... ,F12.6/,35H     ZERO-LIFT DRAG COEEFICIENT
     $.....,F12.6/,35H     CRITICAL MACH NC (FOR CL = 0)..,F12.6)
2930  FORMAT (///48H ENTER THE VALUE OF THE CRITICAL MACH NUMBER AT ,/,2
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     11H ZERC ANGLE OF ATTACK)
2940  FORMAT (51H ENTER THE VALUE OF THE MAXIMUM COEFFICIENT OF LIFT,/,2
     16H FOR YOUR SELECTED AIRFOIL)
2950  FORMAT (53H ENTER THE VALUE OF THE VELCCITY WHERE THE RETREATING,/
     1,42H BLADE STALL ANGLE IS NEAREST 12.5 DEGREES)
2960  FORMAT (///42H ENTER THE SPAN OF THE VERTICAL STABILIZER)
2970  FORMAT (29H THE TAIL ROTOR SOLIDITY IS  ,F9.7,//,35H ENTER THE VER
     1TICAL STABILIZER AREA)
2980  FORMAT (////36H           VERTICAL STABILIZER DATA ,// ,40X,23H   8
     10 KNOTS    160 KNOTS,/,37H SECTION COEFFICIENT OF LIFT         ,5X,
     2F8.5,5X,F8.5,/,37H ANGLE OF ATTACK TO UNLOAD TAIL ROTJR,6X,F6.3,7X
     3,F6.3)
      END
```

## D. SAMPLE OLTPUT

```
GROSS WEIGHT (LBS)              =  14400.00
EMPTY WEIGHT (LBS)              =   4320.00
SONIC SPEED (FPS)               =   1116.89
MAXIMUM TIP VELOCITY (FPS)      =    725.98
DISK LOADING                    =      7.10
ROTOR RADIUS (FT)               =     25.41
ROTATIONAL VELOCITY (RPS)       =     28.57
TIP VELOCITY (FPS)              =    725.98
COEFFICIENT CF TFRUST           =      0.005668
ADVANCE RATIC (MU)              =      0.3721
BLADE LOADINC                   =      0.0960
SOLIDITY                        =      0.0590377
NUMBER OF MAIN RCTOR BLADES     =      4
CHORD MAIN RCTOR BLADE (FT)     =      1.178138
              THE ASPECT RATIO IS     =        21.567
              TFE ROTATIONAL SPEED IS=         28.572



GROSS WEIGHT (LBS)              =  14400.00
EMPTY WEIGHT (LBS)              =   4320.00
SONIC SPEED (FPS)               =   1116.89
MAXIMUM TIP VELOCITY (FPS)      =    725.98
DISK LOADING (LBS/SF)           =      7.10
ROTOR RADIUS (FT)               =     25.41
ROTATIONAL VELOCITY (RPS)       =     27.00
TIP VELOCITY (FPS)              =    686.03
COEFFICIENT OF TFRUST           =      0.006347
ADVANCE RATIC (MU)              =      0.3937
BLADE LOADING                   =      0.0920
SOLIDITY                        =      0.0689887
NUMBER OF MAIN RCTOR BLADES     =      4
CHORD MAIN ROTOR BLADE (FT)     =      1.377
ASPECT RATIO CF MAIN ROTOR      =     18.46
COEFF OF LIFT (AVG)             =      0.5520
COEFF OF LIFT W/R ALPHA         =      6.3025
COEFF OF DRAG @ 0 LIFT          =      0.0100
```

```
TIP LOSS FACTCR                    =      0.9721020
POWER (INDUCED)(HP)                =   1310.3
POWER (PROFILE)(HP)                =    353.6
POWER (TOTAL)(HP)                  =   1663.9
EMPTY WEIGHT (LBS)                 =   8867.39
FUEL WEIGHT (LBS)                  =   4000.00
NUMBER OF PECPLE                   =     14
USEFUL LOAD (LBS)                  =   4500.00
NUMBER OF ENGINES                  =      2
ESTIMATED GROSS WEIGHT(LBS)        =  17367.39
SOLIDITY                           =      0.0762025
ROTOR RADIUS (FT)                  =     26.734
HOVER POWER (HP)                   =   1663.9
ROTOR WEIGHT(LBS)                  =   1725.18
TAIL: ROTOR (LBS)                  =     88.54
      STRUCTURE (LBS)              =    111.77
BODY (LBS)                         =   1323.89
LANDING GEAR (LBS)                 =    624.21
NACELLE (LBS)                      =    178.53
PROPULSION: ENGINE (LBS)           =   1215.64
            CRIVE (LBS)            =    957.32
            FUEL TANKS (LBS)=      676.30
FLIGHT CONTRCLS (LBS)              =    587.49
AUXILLARY POWER (LBS)              =    190.00
INSTRUMENTS (LBS)                  =    103.83
HYDRAULICS (LBS)                   =     74.42
ELECTRICAL (LBS)                   =    407.26
AVIONICS (LBS)                     =    309.11
FURNISHINGS (LBS)                  =    432.75
AIR AND ICE (LBS)                  =     83.72
LOAD AND HANCLING (LBS)            =     84.50

REVISED EMPTY WEIGHT (LBS)         =   9174.45
REVISED GROSS WEIGHT (LBS)         =  17674.45


FIGLRE OF MERIT (%)                = 78.747
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```
                              MAIN ROTOR POWER PROFILE
                                         @ SSL
                          ----------------POWER-------------------------
AIRSPEED     TIP       INDUCED          PROFILE         PARASITE          TOTAL
(KNCTS)      MACH       (SHP)            (SHP)            (SHP)            (SHP)
    0.0      0.65      1335.01          353.65            0.0           1688.66
    5.00     0.66      1320.66          353.85            0.04          1674.55
   10.00     0.67      1278.58          354.47            0.30          1633.35
   15.00     0.67      1211.97          355.50            1.03          1568.49
   20.00     0.68      1126.64          356.94            2.44          1486.02
   25.00     0.69      1030.82          358.78            4.76          1394.36
   30.00     0.70       933.41          361.05            8.23          1302.68
   35.00     0.70       841.59          363.72           13.06          1218.37
   40.00     0.71       759.33          366.80           19.50          1145.63
   45.00     0.72       687.74          370.30           27.76          1085.80
   50.00     0.73       626.25          374.20           38.08          1038.53
   55.00     0.73       573.59          378.52           50.69          1002.80
   60.00     0.74       528.38          383.25           65.81           977.44
   65.00     0.75       489.36          388.39           83.67           961.41
   70.00     0.76       455.44          393.94          104.50           953.88
   75.00     0.76       425.77          399.90          128.53           954.20
   80.00     0.77       399.62          406.27          155.99           961.89
   85.00     0.78       376.44          413.05          187.11           976.60
   90.00     0.79       355.76          420.25          222.10           998.11
   95.00     0.79       337.20          427.85          261.22          1026.27
  100.00     0.80       320.46          435.87          304.67          1061.00
  105.00     0.81       305.29          444.30          352.69          1102.28
  110.00     0.82       291.48          453.14          405.52          1150.13
  115.00     0.82       278.86          462.39          463.37          1204.61
  120.00     0.83       267.28          472.05          526.47          1265.80
  125.00     0.84       256.61          482.12          595.06          1333.80
  130.00     0.85       246.77          492.61          669.36          1408.74
  135.00     0.85       237.65          503.50          749.60          1490.76
  140.00     0.86       229.16          514.81          836.02          1579.98
  145.00     0.87       221.31          526.52          928.83          1676.66
  150.00     0.88       213.94          538.65         1028.26          1780.85
  155.00     0.88       207.03          551.19         1134.55          1892.77
  160.00     0.89       200.55          564.14         1247.93          2012.63
  165.00     0.90       194.49          577.50         1368.62          2140.61
  170.00     0.91       188.75          591.28         1496.84          2276.87
  175.00     0.91       183.41          605.46         1632.84          2421.71
  180.00     0.92       178.30          620.05         1776.84          2575.19
  185.00     0.93       173.43          635.06         1929.06          2737.55
  190.00     0.94       168.90          650.48         2089.73          2909.11
```

```
                    MAIN ROTOR POWER PROFILE
          AT SPECIFICATION ALTITUDE AND TEMPERATURE
                  ------------------POWER------------------------
AIRSPEED   TIP     INDUCED     PROFILE     PARASITE      TOTAL
(KNCTS)    MACH     (SHP)       (SHP)       (SHP)        (SHP)
   0.0     0.63    1388.74      326.81        0.0       1715.55
    5.00   0.64    1374.93      327.00        0.04      1701.97
   10.00   0.64    1334.39      327.57        0.28      1662.24
   15.00   0.65    1269.92      328.52        0.95      1599.40
   20.00   0.66    1186.67      329.85        2.25      1518.77
   25.00   0.67    1091.99      331.56        4.40      1427.95
   30.00   0.67     994.20      333.65        7.60      1335.45
   35.00   0.68     900.45      336.12       12.07      1248.65
   40.00   0.69     815.19      338.97       18.02      1172.18
   45.00   0.69     740.10      342.20       25.66      1107.95
   50.00   0.70     675.03      345.81       35.19      1056.03
   55.00   0.71     618.95      349.80       46.84      1015.60
   60.00   0.72     570.60      354.17       60.82       985.58
   65.00   0.72     528.74      358.92       77.32       964.97
   70.00   0.73     492.27      364.05       96.57       952.89
   75.00   0.74     460.33      369.55      118.78       948.66
   80.00   0.75     432.14      375.44      144.16       951.74
   85.00   0.75     407.13      381.71      172.91       961.75
   90.00   0.76     384.80      388.36      205.25       978.42
   95.00   0.77     364.76      395.39      241.40      1001.54
  100.00   0.78     346.67      402.80      281.55      1031.02
  105.00   0.78     330.28      410.59      325.93      1066.80
  110.00   0.79     315.35      418.76      374.75      1108.85
  115.00   0.80     301.71      427.30      428.21      1157.22
  120.00   0.80     289.18      436.23      486.52      1211.94
  125.00   0.81     277.65      445.54      549.91      1273.10
  130.00   0.82     267.01      455.23      618.57      1340.81
  135.00   0.83     257.14      465.30      692.73      1415.17
  140.00   0.83     247.98      475.75      772.58      1496.31
  145.00   0.84     239.43      486.57      858.35      1584.35
  150.00   0.85     231.49      497.78      950.24      1679.52
  155.00   0.86     224.00      509.37     1048.47      1781.83
  160.00   0.86     217.06      521.34     1153.24      1891.64
  165.00   0.87     210.45      533.68     1264.77      2008.90
  170.00   0.88     204.28      546.41     1383.27      2133.96
  175.00   0.88     198.43      559.52     1508.95      2266.90
  180.00   0.89     192.94      573.01     1642.02      2407.96
  185.00   0.90     187.68      586.87     1782.69      2557.25
  190.00   0.91     182.76      601.12     1931.17      2715.05
```

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           TAIL ROTOR RADIUS (FT)=   5.451
           TAIL ROTOR SPEED (RPS)= 122.201
           TAIL ROTOR CDO        =   0.0138000

                    TAIL ROTOR POWER PROFILE
                              @ SSL
                              POWER
    AIRSPEED  TIP-----------------------------------------------
    (KNOTS)   MACH      INDUCED         PROFILE          TOTAL
                         (SHP)           (SHP)           (SHP)
       0.0    0.60      95.87           43.67           139.54
       5.00   0.60      93.94           43.70           137.63
      10.00   0.61      88.34           43.79           132.13
      15.00   0.62      79.67           43.94           123.61
      20.00   0.63      68.94           44.15           113.09
      25.00   0.63      57.45           44.42           101.87
      30.00   0.64      46.56           44.75            91.31
      35.00   0.65      37.26           45.14            82.40
      40.00   0.66      29.91           45.60            75.50
      45.00   0.66      24.37           46.11            70.48
      50.00   0.67      20.29           46.68            66.97
      55.00   0.68      17.31           47.31            64.62
      60.00   0.69      15.13           48.01            63.14
      65.00   0.69      13.54           48.76            62.30
      70.00   0.70      12.40           49.57            61.97
      75.00   0.71      11.59           50.45            62.04
      80.00   0.72      11.05           51.38            62.43
      85.00   0.72      10.73           52.38            63.11
      90.00   0.73      10.59           53.43            64.02
      95.00   0.74      10.62           54.55            65.16
     100.00   0.75      10.79           55.72            66.51
     105.00   0.76      11.10           56.96            68.06
     110.00   0.76      11.54           58.26            69.80
     115.00   0.77      12.12           59.61            71.73
     120.00   0.78      12.83           61.03            73.86
     125.00   0.79      13.69           62.51            76.20
     130.00   0.79      14.70           64.04            78.74
     135.00   0.80      15.87           65.64            81.51
     140.00   0.81      17.21           67.30            84.51
     145.00   0.82      18.73           69.02            87.75
     150.00   0.82      20.45           70.80            91.25
     155.00   0.83      22.38           72.63            95.02
     160.00   0.84      24.55           74.53            99.08
     165.00   0.85      26.96           76.49           103.46
     170.00   0.85      29.65           78.51           108.16
     175.00   0.86      32.63           80.59           113.22
     180.00   0.87      35.92           82.73           118.65
     185.00   0.88      39.55           84.93           124.48
     190.00   0.88      43.55           87.19           130.75
```

```
                     TAIL ROTOR POWER PROFILE
          AT SPECIFICATION ALTITUDE AND TEMPERATURE
                               POWER
AIRSPEED  -TIP-------INDUCED-------PROFILE--------TOTAL-
(KNOTS)    MACH      (SHP)         (SHP)         (SHP)
   0.0     0.58     102.31         40.35        142.66
   5.00    0.58     100.38         40.38        140.76
  10.00    0.59      94.79         40.46        135.25
  15.00    0.60      86.08         40.60        126.69
  20.00    0.61      75.18         40.80        115.98
  25.00    0.61      63.33         41.05        104.38
  30.00    0.62      51.83         41.36         93.19
  35.00    0.63      41.76         41.72         83.48
  40.00    0.64      33.60         42.14         75.73
  45.00    0.64      27.33         42.61         69.94
  50.00    0.65      22.65         43.14         65.79
  55.00    0.66      19.19         43.72         62.91
  60.00    0.66      16.64         44.36         61.00
  65.00    0.67      14.76         45.06         59.82
  70.00    0.68      13.39         45.81         59.20
  75.00    0.69      12.40         46.62         59.02
  80.00    0.69      11.71         47.48         59.20
  85.00    0.70      11.27         48.40         59.67
  90.00    0.71      11.02         49.38         60.40
  95.00    0.72      10.95         50.41         61.36
 100.00    0.72      11.03         51.50         62.52
 105.00    0.73      11.25         52.64         63.89
 110.00    0.74      11.61         53.84         65.45
 115.00    0.75      12.11         55.09         67.20
 120.00    0.75      12.74         56.40         69.14
 125.00    0.76      13.51         57.76         71.27
 130.00    0.77      14.42         59.18         73.60
 135.00    0.77      15.48         60.66         76.14
 140.00    0.78      16.71         62.19         78.90
 145.00    0.79      18.11         63.78         81.89
 150.00    0.80      19.69         65.42         85.11
 155.00    0.80      21.47         67.12         88.60
 160.00    0.81      23.47         68.88         92.35
 165.00    0.82      25.70         70.69         96.39
 170.00    0.83      28.19         72.55        100.74
 175.00    0.83      30.94         74.48        105.42
 180.00    0.84      33.99         76.45        110.45
 185.00    0.85      37.36         78.49        115.84
 190.00    0.85      41.06         80.58        121.64
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            VERTICAL STABILIZER DATA

                                                    80 KNOTS    160 KNOTS
    SECTION COEFFICIENT OF LIFT                     0.83326       0.46359
    ANGLE OF ATTACK TO UNLOAD TAIL ROTOR            22.263         3.268



      RADIUS...........................         26.733826
      MAIN ROTOR CHCRD.................          1.600000
      NUMBER OF MAIN ROTOR BLADES......          0.000000
      AICRAFT GRCSS WEIGHT............. 17585.0703
      ROTOR TIP VELCCITY...............   725.978027
      HORIZONTAL FLAT PLATE AREA.......    29.308441
      NUMBER OF ENGINES IN HELICOPTER..     0.000000



      MAIN ROTOR HEIGHT ABOVE GROUND...    23.000000
      AIR DENSITY (RHO).............     0.002197
      SONIC VELCCITY...................  1154.32056
      BLADE GECMETRIC TWIST............    -0.174533



      MAXIMUM 2-D LIFT COEFFICIENT.....     1.250000
      2-D STATIC STALL ANGLE (AMAX)....     0.1983330
      LIFT CURVE SLCPE (/RAD)..........     6.302530
      ZERO-LIFT CRAG COEEFICIENT.....    0.010000
      CRITICAL MACH NO (FOR CL = 0)..    0.720000
      COEFFICIENT OF THRUST............     0.006765
      DISC AREA........................  2245.28784
      SOLIDITY.........................     0.076202
      TIP-LOSS FACTCR..................     0.970920
      GROUND EFFECT RATIO..............     0.874897
```

```
*************************************************
     FORWARD VELOCITY IN KNOTS    =      0.0
*************************************************
DISK PLANE ANGLE OF ATTACK =   0.0

    DYNAMIC PARAMETERS
A11...............................  0.0
A12...............................  0.0
A13...............................  0.0
A14...............................  1.000000
T1................................  0.471343
T2................................  0.305091
T3................................  0.222164
T4................................  0.0
INFLOW RATIO (LAMBDA)............ -0.058160

     STALL POWER CALCULATIONS
RT..................................   -0.028292

INBOARD STALL CORRECTION FACTOR......        0.0
STALL POWER COEFFICIENT.............      0.0

ANGLE OF ATTACK CALCULATIONS
LONGITUDINAL CYCLIC ANGLE(DEG).....  0.0
LONGITUDINAL COLLECTIVE ANGLE(DEG). 17.720932
ALPHA(90) (DEG)....................  4.388375
ALPHA(270) (DEG)...................  4.388375

     HIGH SPEED MACH EFFECTS

ADVANCING BLADE TIP MACH NUMBER...    0.628922
CRITICAL MACH NUMBER..............    0.665450
DRAG DIVERGENCE MACH NUMBER.......    0.0
COMPRESSIBILITY POWER COEFF.......     0.0


****************************************************

   MAIN ROTOR POWER REQUIRED
****************************************************

 INDUCED POWER =             1388.74
 PROFILE POWER =              326.81
 PARASITE POWER =               0.0
 COMPRESIBILITY POWER =         0.0
 STALL POWER =                  0.0

 HIGH SPEED EFFECTS =        0.0
```

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*****************************************************
    FORWARD VELOCITY IN KNOTS   =   140.00
*****************************************************

   DYNAMIC PARAMETERS
A11..............................  0.711244
A12..............................  0.947375
A13..............................  0.689869
A14..............................  1.238236
T1...............................  0.497838
T2...............................  0.356539
T3...............................  0.247140
T4...............................  0.157756
INFLOW RATIO (LAMBDA)............ -0.053642

    STALL PCWER CALCULATIONS

RT.................................     0.002215
INBOARD STALL CORRECTION FACTOR......        0.5647528
STALL PCWER COEFFICIENT..............      0.0000402

ANGLE OF ATTACK CALCULATIONS

LONGITUDINAL CYCLIC ANGLE(DEG)..... -7.126393
LONGITUDINAL COLLECTIVE ANGLE(DEG). 18.903610
ALPHA(90) (DEG).................... -0.541373
ALPHA(270) (CEG)................... 13.710670

    HIGH SPEED MACH EFFECTS

ADVANCING BLADE TIP MACH NUMBER...    0.833665
CRITICAL MACH NUMBER..............    0.726730
DRAG DIVERGENCE MACH NUMBER.......    0.046935
COMPRESSIEILITY POWER COEFF........    0.000044


******************************************************

   MAIN FCTOF POWER REQUIRED
******************************************************

  INDUCED POWER =            247.98
  PROFILE POWER =            475.75
  PARASITE POWER =           772.58
  COMPRESIBILITY POWER =      149.96
  STALL FCWER =               137.91

  HIGH SPEED EFFECTS =      287.86
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```
NOTE THE VELCCITY THAT HAS THE STALL ANGLE LESS
THAN OR EQUAL TO 12.5 DEGREES

   VELOCITY          ANGLE
    (KNOTS)          (DEG)

    126.94            12.1

    127.94            12.2

    128.94            12.3

    129.94            12.4

    130.94            12.6

    131.94            12.7

    132.94            12.8

    133.94            12.9



TOTAL POWER FOR THE AIRCRAFT TO HOVER IS=   1829.48
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```
                    TOTAL ROTOR POWER PROFILE
                              @ SSL
                                 POWER
AIRSPEED     INDUCED------PROFILE------PARASITE------COMP----------TOTAL
(KNOTS)       (SHP)        (SHP)        (SHP)        (SHP)          (SHP)
    0.0      1430.88       397.31         0.0          0.0         1828.19
    5.00     1414.59       397.55         0.04         0.0         1812.18
   10.00     1366.92       398.26         0.30         0.0         1765.48
   15.00     1291.64       399.43         1.03         0.0         1692.10
   20.00     1195.58       401.08         2.44         0.0         1599.10
   25.00     1088.26       403.20         4.76         0.0         1496.23
   30.00      979.97       405.80         8.23         0.0         1393.99
   35.00      878.84       408.86        13.06         0.0         1300.77
   40.00      789.23       412.40        19.50         0.0         1221.13
   45.00      712.11       416.40        27.76         0.0         1156.27
   50.00      646.54       420.88        38.08         0.0         1105.50
   55.00      590.90       425.83        50.69         0.0         1067.42
   60.00      543.51       431.25        65.81         0.0         1040.57
   65.00      502.90       437.15        83.67         0.0         1023.71
   70.00      467.84       443.51       104.50         0.0         1015.85
   75.00      437.36       450.35       128.53         0.0         1016.24
   80.00      410.68       457.65       155.99         0.0         1024.32
   85.00      387.17       465.43       187.11         0.0         1039.71
   90.00      366.35       473.68       222.10         0.0         1062.13
   95.00      347.81       482.40       261.22         0.0         1091.43
  100.00      331.24       491.59       304.67         0.0         1127.51
  105.00      316.38       501.26       352.69        11.43        1181.76
  110.00      303.02       511.39       405.52        31.39        1251.32
  115.00      290.97       522.00       463.37        51.64        1327.98
  120.00      280.11       533.08       526.47        72.18        1411.85
  125.00      270.31       544.63       595.06        93.04        1503.04
  130.00      261.47       556.65       669.36       114.24        1601.73
  135.00      253.52       569.14       749.60       135.80        1708.07
  140.00      246.37       582.11       836.02       157.74        1822.23
  145.00      240.04       595.54       928.83       180.09        1944.50
  150.00      234.39       609.45      1028.26       300.73        2172.83
  155.00      229.41       623.83      1134.55       410.13        2397.91
  160.00      225.10       638.67      1247.93       450.93        2562.63
  165.00      221.46       653.99      1368.62       479.91        2723.98
  170.00      218.39       669.79      1496.84       502.78        2887.80
  175.00      216.04       686.05      1632.84       522.22        3057.15
  180.00      214.22       702.79      1776.84       539.78        3233.62
  185.00      212.98       719.99      1929.06       556.41        3418.44
  190.00      212.45       737.67      2089.73       572.74        3612.59
```

```
                 TOTAL ROTOR POWER PROFILE
        AT SPECIFICATION ALTITUDE AND TEMPERATURE
                 ------------------POWER------------------------------------
AIRSPEED      INDUCED       PROFILE      PARASITE       COMP         TOTAL
(KNOTS)        (SHP)         (SHP)        (SHP)         (SHP)        (SHP)
   0.0        1491.04       367.17         0.0           0.0        1858.21
   5.00       1475.31       367.38         0.04          0.0        1842.73
  10.00       1429.18       368.04         0.28          0.0        1797.50
  15.00       1356.00       369.13         0.95          0.0        1726.08
  20.00       1261.85       370.65         2.25          0.0        1634.75
  25.00       1155.31       372.61         4.40          0.0        1532.32
  30.00       1046.03       375.01         7.60          0.0        1428.64
  35.00        942.21       377.84        12.07          0.0        1332.12
  40.00        848.79       381.11        18.02          0.0        1247.91
  45.00        767.43       384.81        25.66          0.0        1177.89
  50.00        697.67       388.95        35.19          0.0        1121.81
  55.00        638.14       393.52        46.84          0.0        1078.51
  60.00        587.24       398.53        60.82          0.0        1046.59
  65.00        543.50       403.98        77.32          0.0        1024.80
  70.00        505.67       409.86        96.57          0.0        1012.10
  75.00        472.73       416.18       118.78          0.0        1007.68
  80.00        443.86       422.93       144.16          0.0        1010.94
  85.00        418.40       430.12       172.91          0.0        1021.42
  90.00        395.82       437.74       205.25          0.0        1038.81
  95.00        375.70       445.80       241.40          0.0        1062.90
 100.00        357.70       454.29       281.55          0.49       1094.04
 105.00        341.53       463.22       325.93         18.14       1148.82
 110.00        326.96       472.59       374.75         36.06       1210.36
 115.00        313.81       482.39       428.21         54.26       1278.67
 120.00        301.92       492.63       486.52         72.75       1353.82
 125.00        291.16       503.30       549.91         91.55       1435.92
 130.00        281.43       514.41       618.57        110.67       1525.08
 135.00        272.62       525.96       692.73        130.13       1621.44
 140.00        264.69       537.94       772.58        287.86       1863.07
 145.00        257.53       550.35       858.35        380.57       2046.80
 150.00        251.18       563.20       950.24        458.59       2223.22
 155.00        245.47       576.49      1048.47        484.69       2355.12
 160.00        240.53       590.21      1153.24        498.32       2482.30
 165.00        236.15       604.37      1264.77        509.39       2614.69
 170.00        232.46       618.97      1383.27        519.13       2753.83
 175.00        229.37       634.00      1508.95        528.34       2900.66
 180.00        226.93       649.46      1642.02        537.54       3055.96
 185.00        225.04       665.36      1782.69        547.12       3220.21
 190.00        223.82       681.70      1931.17        557.34       3394.03
```

```
THE REQUIRED SHAFT HCRSEPOWER IS  =   3013.56


FOR 2 ENGINE(S), THE REQUIRED SHAFT HORSEPOWER IS=   3415.32
                              ENGINE SELECTION CRITERIA
                                ------------- 1 ENGINE ------------------
                               A         B        C        D        E        F
POWERPLANT WEIGHT(LB):      158.0     288.0    423.0    709.0    580.0    750.0
LIFE-CYCLE CCST($10M):       3.00      5.97    10.95    14.50    18.13    25.39
ENGINE LIFE(HRS):           600.0     750.0    800.0    800.0   1000.0    750.0
NUMBER OF REFLACEMENT:        4.0       3.0      3.0      3.0      2.0      3.0
R AND D COSTS($K):            0.0       0.0      0.0      0.0      0.0      0.0
INTIAL COSTS($K):            93.0     100.0    580.0    360.0    640.0    700.0
YEAR MAINT COST($K):         7.50     15.00    30.00    37.50    48.00    66.00
YEAR OPERATE COST($K):       2.40      4.80     6.00    10.50    12.00    18.00
REPLACEMENT CCST($K):      125.55    135.00   783.00   486.00   864.00   945.00
SALVAGE VALUE($K):          74.40     80.00   464.00   288.00   512.00   560.00
AVAILABILITY(ENG):         0.8333    0.8333   0.8000   0.6977   0.6667   0.5738
RELIABILITY(ENG):          0.9892    0.9905   0.9903   0.9930   0.9929   0.9938
MAINTAINABILITY(ENG):       0.350     0.300    0.250    0.650    1.000    1.300
PERFORMANCE(SHP-MIL):       420.0     708.0   1561.0   1800.0   2500.0   3400.0


                              ENGINE SELECTION CRITERIA
                                --------- 2 ENGINE(S) --------------
                               A         B        C        D        E        F
POWERPLANT WEIGHT(LB):      316.0     576.0    846.0   1418.0   1160.0   1500.0
LIFE-CYCLE COST($10M):       6.00     11.93    21.91    28.99    36.27    50.77
ENGINE LIFE(HRS):           600.0     750.0    800.0    800.0   1000.0    750.0
NUMBER OF REPLACEMENT:        8.0       6.0      5.0      5.0      4.0      6.0
R AND D COSTS($K):            0.0       0.0      0.0      0.0      0.0      0.0
INTIAL COSTS($K):           186.0     200.0   1160.0    720.0   1280.0   1400.0
YEAR MAINT CCST($K):        15.00     30.00    60.00    75.00    96.00   132.00
YEAR OPERATE COST($K):       4.80      9.60    12.00    21.00    24.00    36.00
REPLACEMENT COST($K):      251.10    270.00  1566.00   972.00  1728.00  1890.00
SALVAGE VALUE($K):         148.80    160.00   928.00   576.00  1024.00  1120.00
AVAILABILITY(ENG):         0.8333    0.8333   0.8000   0.6977   0.6667   0.5738
RELIABILITY(ENG):          0.9892    0.9905   0.9903   0.9930   0.9929   0.9938
MAINTAINABILITY(ENG):       0.350     0.300    0.250    0.650    1.000    1.300
PERFORMANCE(SHP-MIL):       840.0    1416.0   3122.0   3600.0   5000.0   6800.0
THE REQUIRED SHAFT HCRSEPOWER IS  =   3415.32


OLD GROSS WEIGHT =  17585.07
NEW GROSS WEIGHT =  18409.23
```

```
 ------------------FUEL FLOW RATES----------------
MILITARY POWER      NORMAL POWER      CRUISE POWER
   2142.00             1854.36           1517.66



TEMPERATURE (R)                  =    504.423
PRESSURE (PSF)                   =   1827.697
ALPHA AT SSL                     =    624.344
THETA AT SPEC ALTITUDE           =      0.972
DELTA AT SPEC ALTITUDE           =      0.864
ZERC HORSEPCWER INTERCEPT
AT SPEC ALTITUDE                 =    531.755


THE ZERO HORSEPOWER INCREMENT AT ALTITUDE=  2221.240



THE FUEL WEIGHT IS   =   3959.12LBS
THE DESIGN GROSS WEIGHT IS     =  18368.34
THE ESTIMATEC GRCSS WEIGHT IS =  17585.07


THE BEST RATE OF CLIMB IS   3800.00 FEET PER MINUTE


THE HOVER CEILINC ALTITUDE IS =  12000.00


THE SERVICE CEILING ALTITUDE IS =  21000.00
```

```
                          HELICOPTER DESIGN
                               AE4306
                            FINAL SUMMARY

                             PERFORMANCE

                                         SPECIFICATION          DESIGN
CREW..................................             3                14
INTERNAL LOAD(LBS)....................        3750.0            4500.0
SERVICE CEILING(FT)...................       17500.0           21000.0
HOVER IGE (FT)........................       12000.0           12000.0
VELOCITY (KTS) CRUISE.................         135.0             170.0
               MAXIMUM................         160.0             196.0
               MAX ENDURANCE..........                            70.0
               MAX RANGE..............                           170.0
               RETREATING BLADE STALL...                         130.0
MAXIMUM RANGE (NMI)...................         250.0             250.0
MAXIMUM RATE OF CLIMB (FT/MIN)........        2500.0            3800.0
ENGINE - NUMBER.......................                               2
         TYPE.........................                               D
         SHP (SSL) MILITARY...........                          3600.0

                              GEOMETRY

WEIGHT (LBS) - MAX GROSS..............       18000.0           18368.3
               EMPTY..................                          9095.5
FUEL CAPACITY (GAL) -INTERNAL.........                           609.1
                     EXTERNAL.........                             0.0
MAIN ROTOR - CHORD (FT)...............                            1.60
             RADIUS (FT)..............         29.00             26.73
             NUMBER OF BLADES.........                               4
             DRAG COEFFICIENT.........                          0.0100
             ROTATIONAL VELOCITY......                           27.16
             SOLIDITY.................                        0.076202
TAIL ROTOR - CHORD (FT)...............                            0.91
             RADIUS (FT)..............                            5.45
             NUMBER BLADES............                               4
             DRAG COEFFICIENT.........                          0.0138
             ROTATIONAL VELOCITY......                          122.20
             SOLIDITY.................                        0.212207
VERTICAL TAIL AREA (FT)...............                           55.43
FUSELAGE LENGTH (FT)..................         56.00             50.10
EQUIVALENT FLAT PLAGE AREA (FT) FORWARD                          29.31
                                VERTICAL                         58.62
```

```
COST ANALYSIS PER VEHICLE (IN DOLLARS FOR 100 A/C RUN)

     ROTOR                               =   207647.31
     TAIL: RCTOR                         =    11561.87
           STRUCTURE                     =    20104.41
     BODY                                =   182568.06
     LANDING GEAR                        =   119506.94
     NACELLE                             =    34988.90
     PROPULSION:  ENGINE                 =  1281599.00
                  DRIVE                  =   121739.87
                  FUEL TANKS             =   160159.44
     FLIGHT CCNTROLS                     =   109443.50
     AUXILLARY PCWER                     =    54397.60
     INSTRUMENTS                         =    15419.93
     HYDRAULICS                          =     8067.89
     ELECTRICAL                          =    68819.69
     AVIONICS                            =    52901.66
     FURNISHINGS                         =    35208.07
     AIR ANC ICE                         =    21086.03
     LOAD ANC HANDLING                   =    20675.80

     TOTAL CCST PER VEHICLE              =  2525889.00
```

# APPENDIX C

## TABLE III

## AH-64 Data

| Parameter | Value | |
|---|---|---|
| Main rotor radius | 24.0 | feet |
| Tail rotor radius | 4.6 | feet |
| Number of main rotor blades | 4 | |
| Number of tail rotor blades | 4 | |
| Height of the main rotor system | 12.6 | feet |
| Speed of the main rotor | 30.3 | rads/sec |
| Speed of the tail rotor | 147.0 | rads/sec |
| Chord of the main rotor | 1.75 | feet |
| Chord of the tail rotor | 0.83 | feet |
| Span of the main rotor | 18.8 | feet |
| Span of the tail rotor | 3.1 | feet |
| Twist of the main rotor blade | -9.0 | degrees |
| Twist of the tail rotor blade | -8.8 | degrees |
| Profile drag of the main rotor blade | 0.009 | |
| Profile drag of the tail rotor blade | 0.009 | |
| Disc loading of the main rotor system | 8.1 | |
| Width of the fuselage | 3.96 | feet |
| Length of the fuselage | 49.1 | feet |
| Frontal equivalent flat plate area | 34.7 | sq ft |
| Vertical equivalent flat plate area | 45.8 | sq ft |
| Maximum forward velocity | 154 | knots |
| Maximum range | 246 | nmi |
| Rate of climb | 2490 | ft/min |
| Hover ceiling (IGE) | 14,200 | feet |
| Hover ceiling (OGE) | 11,000 | feet |
| Length of the tail | 29.7 | feet |
| Operating weight | 11,010 | pounds |
| Load weight | 2,020 | pounds |
| Fuel weight | 1,620 | pounds |
| Maximum gross weight | 14,650 | pounds |

# TABLE IV

## OH-6A Data

| Parameter | Value | |
|---|---|---|
| Main rotor radius | 16.3 | feet |
| Tail rotor radius | 4.3 | feet |
| Number of main rotor blades | 4 | |
| Number of tail rotor blades | 2 | |
| Height of the main rotor system | 7.0 | feet |
| Speed of the main rotor | 49.2 | rads/sec |
| Speed of the tail rotor | 315.0 | rads/sec |
| Chord of the main rotor | 0.57 | feet |
| Chord of the tail rotor | 0.40 | feet |
| Span of the main rotor | 11.5 | feet |
| Span of the tail rotor | 1.4 | feet |
| Twist of the main rotor blade | -9.0 | degrees |
| Twist of the tail rotor blade | -8.0 | degrees |
| Profile drag of the main rotor blade | 0.009 | |
| Profile drag of the tail rotor blade | 0.009 | |
| Disc loading of the main rotor system | 8.1 | |
| Width of the fuselage | 4.57 | feet |
| Length of the fuselage | 23.0 | feet |
| Frontal equivalent flat plate area | 5.0 | sq ft |
| Vertical equivalent flat plate area | 10.8 | sq ft |
| Maximum forward velocity | 116 | knots |
| Maximum range | 330 | nmi |
| Rate of climb | 500 | ft/min |
| Hover ceiling (IGE) | 7,100 | feet |
| Hover ceiling (OGE) | 4,200 | feet |
| Length of the tail | 15.2 | feet |
| Operating weight | 1,160 | pounds |
| Load weight | 960 | pounds |
| Fuel weight | 400 | pounds |
| Maximum gross weight | 2,520 | pounds |

# TABLE V

## SH-3H Data

| Parameter | Value | |
|---|---|---|
| Main rotor radius | 31.0 | feet |
| Tail rotor radius | 5.3 | feet |
| Number of main rotor blades | 5 | |
| Number of tail rotor blades | 5 | |
| Height of the main rotor system | 14.3 | feet |
| Speed of the main rotor | 21.3 | rads/sec |
| Speed of the tail rotor | 130.0 | rads/sec |
| Chord of the main rotor | 1.52 | feet |
| Chord of the tail rotor | 0.61 | feet |
| Span of the main rotor | 29.3 | feet |
| Span of the tail rotor | 4.0 | feet |
| Twist of the main rotor blade | -8.0 | degrees |
| Twist of the tail rotor blade | 0.0 | degrees |
| Profile drag of the main rotor blade | 0.0095 | |
| Profile drag of the tail rotor blade | 0.0105 | |
| Disc loading of the main rotor system | 6.96 | |
| Width of the fuselage | 7.08 | feet |
| Length of the fuselage | 31.3 | feet |
| Frontal equivalent flat plate area | 31.3 | sq ft |
| Vertical equivalent flat plate area | 36.0 | sq ft |
| Maximum forward velocity | 120 | knots |
| Maximum range | 505 | nmi |
| Rate of climb | 500 | ft/min |
| Hover ceiling (IGE) | 3,700 | feet |
| Hover ceiling (OGE) | 4,000 | feet |
| Length of the tail | 36.6 | feet |
| Operating weight | 13,600 | pounds |
| Load weight | 1,760 | pounds |
| Fuel weight | 5,640 | pounds |
| Maximum gross weight | 21,000 | pounds |

# TABLE VI

## S-76 Data

| Parameter | Value | |
|---|---|---|
| Main rotor radius | 22.0 | feet |
| Tail rotor radius | 4.0 | feet |
| Number of main rotor blades | 4 | |
| Number of tail rotor blades | 4 | |
| Height of the main rotor system | 10.0 | feet |
| Speed of the main rotor | 30.7 | rads/sec |
| Speed of the tail rotor | 168.0 | rads/sec |
| Chord of the main rotor | 1.29 | feet |
| Chord of the tail rotor | 0.54 | feet |
| Span of the main rotor | 17.0 | feet |
| Span of the tail rotor | 3.3 | feet |
| Twist of the main rotor blade | -10.0 | degrees |
| Twist of the tail rotor blade | -8.0 | degrees |
| Profile drag of the main rotor blade | 0.009 | |
| Profile drag of the tail rotor blade | 0.015 | |
| Disc loading of the main rotor system | 8.1 | |
| Width of the fuselage | 7.00 | feet |
| Length of the fuselage | 43.4 | feet |
| Frontal equivalent flat plate area | 11.6 | sq ft |
| Vertical equivalent flat plate area | 30.0 | sq ft |
| Maximum forward velocity | 155 | knots |
| Maximum range | 404 | nmi |
| Rate of climb | 425 | ft/min |
| Hover ceiling (IGE) | 6,200 | feet |
| Hover ceiling (OGE) | 2,800 | feet |
| Length of the tail | 26.5 | feet |
| Operating weight | 5,600 | pounds |
| Load weight | 2,520 | pounds |
| Fuel weight | 1,880 | pounds |
| Maximum gross weight | 10,000 | pounds |

## TABLE VII

## UH-60A Data

| Parameter | Value | |
|---|---|---|
| Main rotor radius | 26.8 | feet |
| Tail rotor radius | 4.0 | feet |
| Number of main rotor blades | 4 | |
| Number of tail rotor blades | 4 | |
| Height of the main rotor system | 11.2 | feet |
| Speed of the main rotor | 27.2 | rads/sec |
| Speed of the tail rotor | 125.0 | rads/sec |
| Chord of the main rotor | 1.75 | feet |
| Chord of the tail rotor | 0.81 | feet |
| Span of the main rotor | 29.3 | feet |
| Span of the tail rotor | 4.25 | feet |
| Twist of the main rotor blade | -18.0 | degrees |
| Twist of the tail rotor blade | -18.0 | degrees |
| Profile drag of the main rotor blade | 0.008 | |
| Profile drag of the tail rotor blade | 0.008 | |
| Disc loading of the main rotor system | 8.95 | |
| Width of the fuselage | 7.75 | feet |
| Length of the fuselage | 50.1 | feet |
| Frontal equivalent flat plate area | 25.7 | sq ft |
| Vertical equivalent flat plate area | 30.8 | sq ft |
| Maximum forward velocity | 156 | knots |
| Maximum range | 275 | nmi |
| Rate of climb | 200 | ft/min |
| Hover ceiling (IGE) | 7,800 | feet |
| Hover ceiling (OGE) | 3,900 | feet |
| Length of the tail | 31.5 | feet |
| Operating weight | 10,680 | pounds |
| Load weight | 7,270 | pounds |
| Fuel weight | 2,350 | pounds |
| Maximum gross weight | 20,250 | pounds |

# TABLE VIII

## CH-54B Data

| Parameter | Value | |
|---|---|---|
| Main rotor radius | 36.0 | feet |
| Tail rotor radius | 8.0 | feet |
| Number of main rotor blades | 6 | |
| Number of tail rotor blades | 4 | |
| Height of the main rotor system | 17.6 | feet |
| Speed of the main rotor | 19.4 | rads/sec |
| Speed of the tail rotor | 66.0 | rads/sec |
| Chord of the main rotor | 1.97 | feet |
| Chord of the tail rotor | 1.28 | feet |
| Span of the main rotor | 29.8 | feet |
| Span of the tail rotor | 6.45 | feet |
| Twist of the main rotor blade | -8.0 | degrees |
| Twist of the tail rotor blade | -8.0 | degrees |
| Profile drag of the main rotor blade | 0.0095 | |
| Profile drag of the tail rotor blade | 0.0105 | |
| Disc loading of the main rotor system | 10.3 | |
| Width of the fuselage | 7.08 | feet |
| Length of the fuselage | 70.2 | feet |
| Frontal equivalent flat plate area | 65.0 | sq ft |
| Vertical equivalent flat plate area | 99.4 | sq ft |
| Maximum forward velocity | 110 | knots |
| Maximum range | 200 | nmi |
| Rate of climb | 189 | ft/min |
| Hover ceiling (IGE) | 6,400 | feet |
| Hover ceiling (OGE) | 2,400 | feet |
| Length of the tail | 44.5 | feet |
| Operating weight | 19,230 | pounds |
| Load weight | 14,190 | pounds |
| Fuel weight | 8,580 | pounds |
| Maximum gross weight | 42,000 | pounds |

# TABLE IX

## CH-53D Data

| Parameter | Value | |
|---|---|---|
| Main rotor radius | 36.1 | feet |
| Tail rotor radius | 8.0 | feet |
| Number of main rotor blades | 6 | |
| Number of tail rotor blades | 4 | |
| Height of the main rotor system | 15.8 | feet |
| Speed of the main rotor | 19.4 | rads/sec |
| Speed of the tail rotor | 83.0 | rads/sec |
| Chord of the main rotor | 2.17 | feet |
| Chord of the tail rotor | 1.28 | feet |
| Span of the main rotor | 28.9 | feet |
| Span of the tail rotor | 6.45 | feet |
| Twist of the main rotor blade | -6.0 | degrees |
| Twist of the tail rotor blade | -8.0 | degrees |
| Profile drag of the main rotor blade | 0.0095 | |
| Profile drag of the tail rotor blade | 0.0095 | |
| Disc loading of the main rotor system | 10.3 | |
| Width of the fuselage | 8.83 | feet |
| Length of the fuselage | 67.2 | feet |
| Frontal equivalent flat plate area | 47.3 | sq ft |
| Vertical equivalent flat plate area | 90.0 | sq ft |
| Maximum forward velocity | 164 | knots |
| Maximum range | 242 | nmi |
| Rate of climb | 625 | ft/min |
| Hover ceiling (IGE) | 14,000 | feet |
| Hover ceiling (OGE) | 8,000 | feet |
| Length of the tail | 44.5 | feet |
| Operating weight | 23,630 | pounds |
| Load weight | 14,030 | pounds |
| Fuel weight | 4,340 | pounds |
| Maximum gross weight | 42,000 | pounds |

## TABLE X

## CH-53E Data

| Parameter | Value | |
|---|---|---|
| Main rotor radius | 38.5 | feet |
| Tail rotor radius | 10.0 | feet |
| Number of main rotor blades | 7 | |
| Number of tail rotor blades | 4 | |
| Height of the main rotor system | 16.0 | feet |
| Speed of the main rotor | 18.7 | rads/sec |
| Speed of the tail rotor | 73.0 | rads/sec |
| Chord of the main rotor | 2.44 | feet |
| Chord of the tail rotor | 1.28 | feet |
| Span of the main rotor | 28.6 | feet |
| Span of the tail rotor | 8.53 | feet |
| Twist of the main rotor blade | -13.6 | degrees |
| Twist of the tail rotor blade | -8.0 | degrees |
| Profile drag of the main rotor blade | 0.009 | |
| Profile drag of the tail rotor blade | 0.0095 | |
| Disc loading of the main rotor system | 15.0 | |
| Width of the fuselage | 8.83 | feet |
| Length of the fuselage | 99.0 | feet |
| Frontal equivalent flat plate area | 120.0 | sq ft |
| Vertical equivalent flat plate area | 63.6 | sq ft |
| Maximum forward velocity | 146 | knots |
| Maximum range | 400 | nmi |
| Rate of climb | 325 | ft/min |
| Hover ceiling (IGE) | 6,000 | feet |
| Hover ceiling (OGE) | 1,400 | feet |
| Length of the tail | 48.0 | feet |
| Operating weight | 24,790 | pounds |
| Load weight | 15,480 | pounds |
| Fuel weight | 25,480 | pounds |
| Maximum gross weight | 73,500 | pounds |

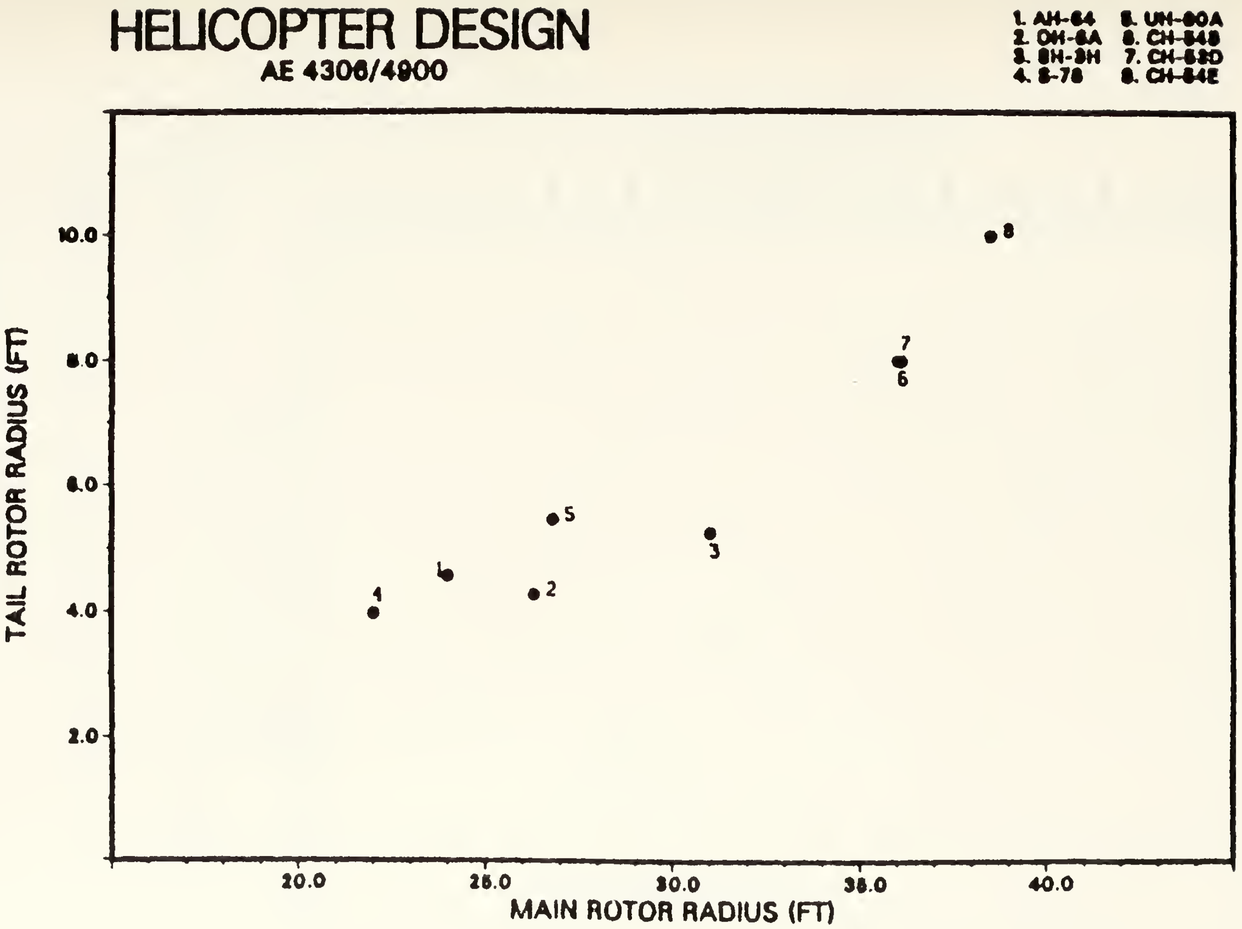

Figure 3.1. X-Y Plot (horizontal page format)

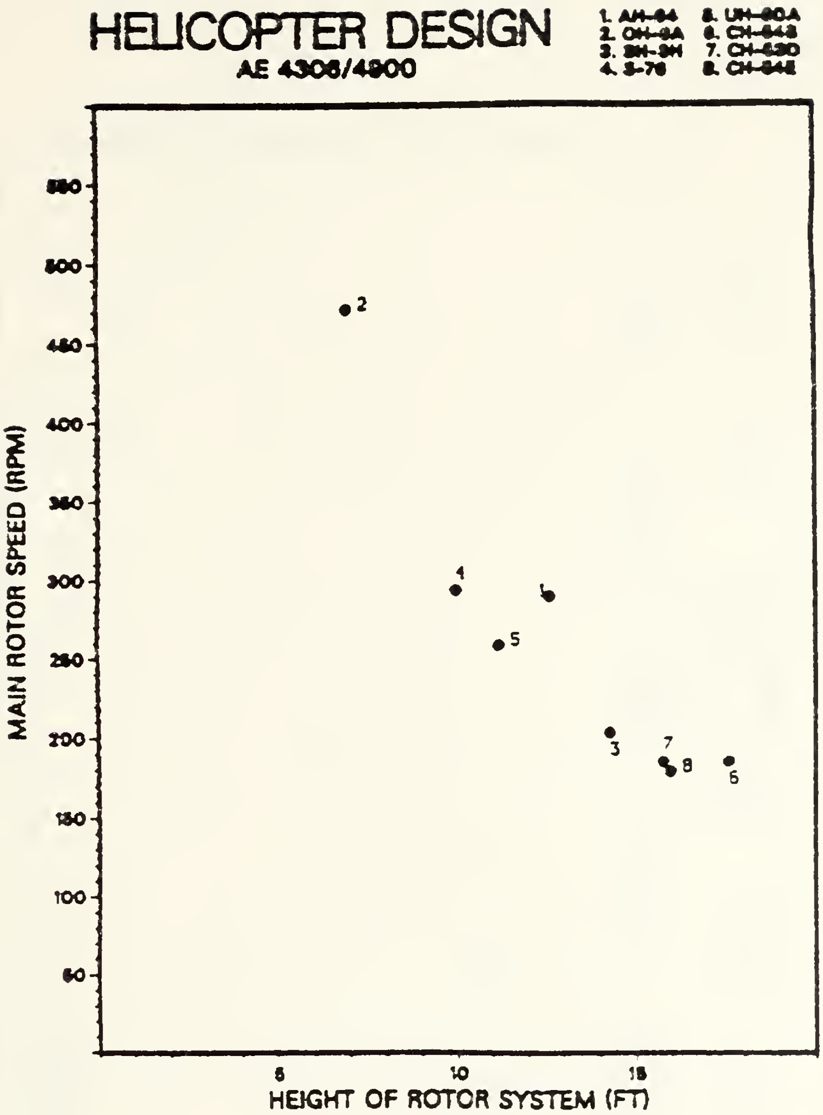

Figure 3.2. X-Y Plot (vertical page format)

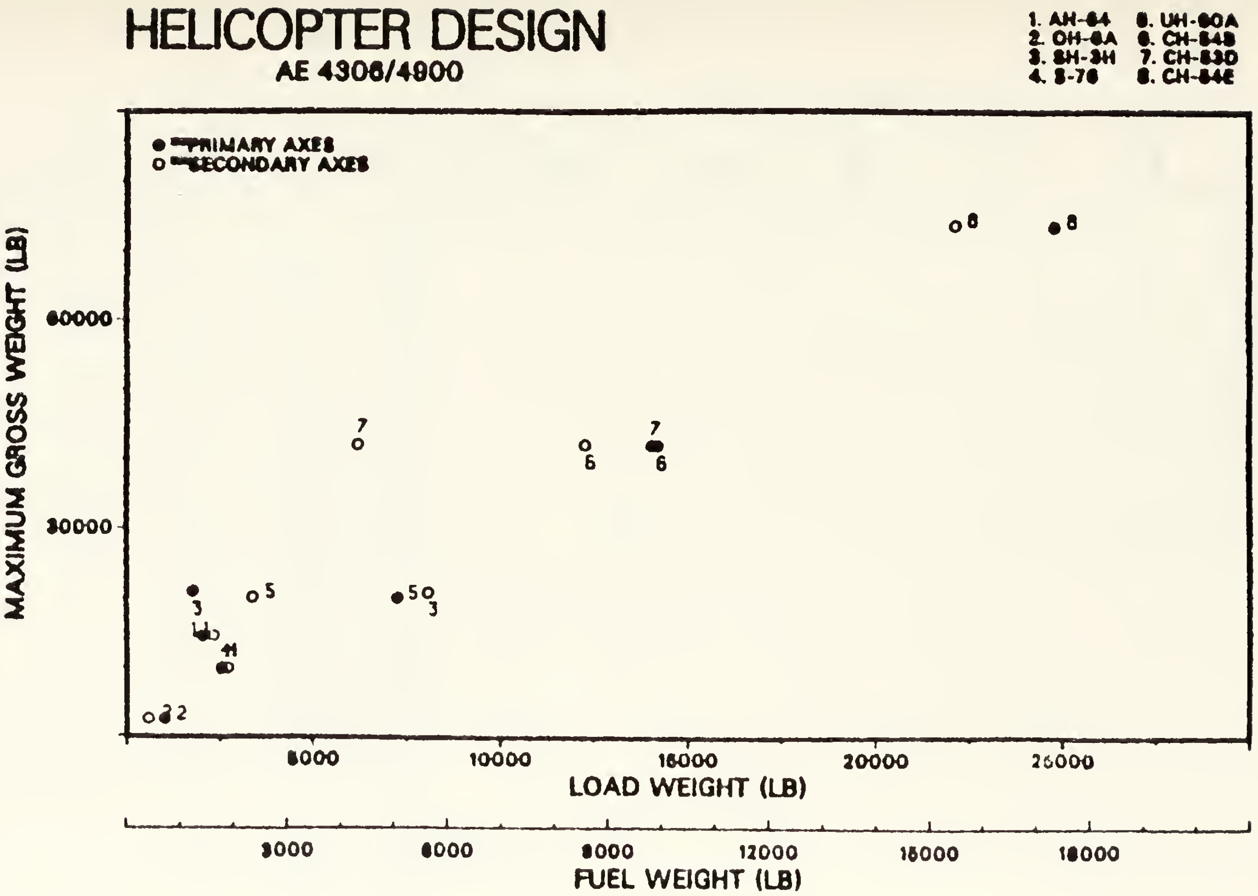

Figure 3.3. Multiple X Axes Plot (horizontal page format)

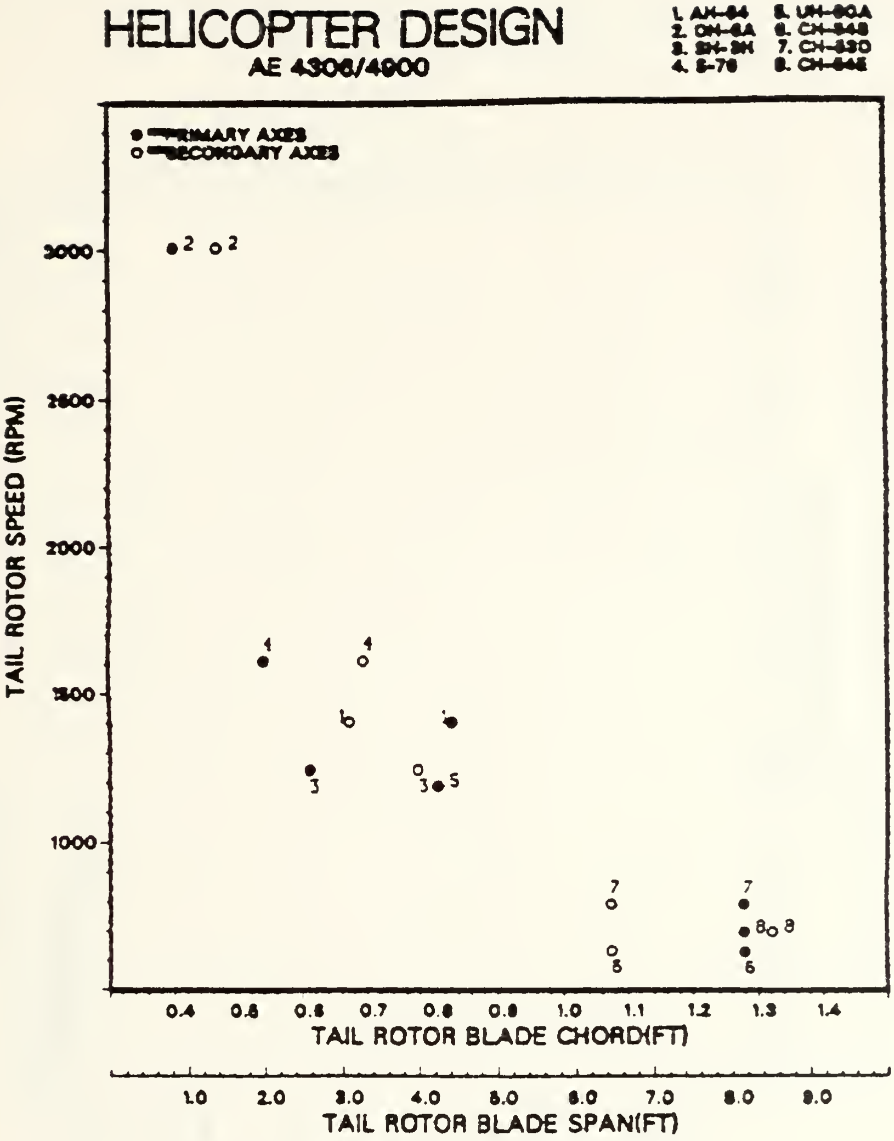

Figure 3.4. Multiple X Axes Plot (vertical page format)

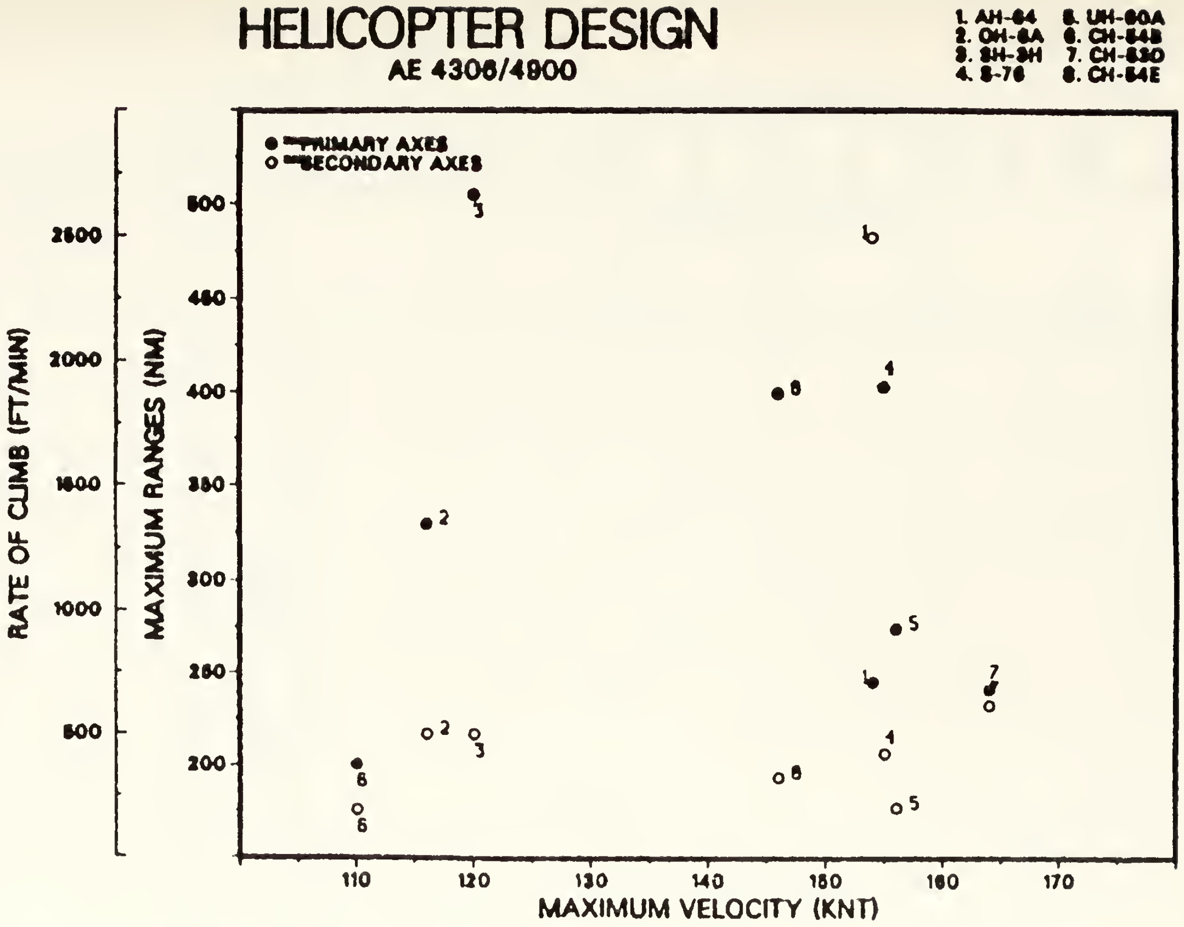

Figure 3.5. Multiple Y Axes Plot (horizontal page format)

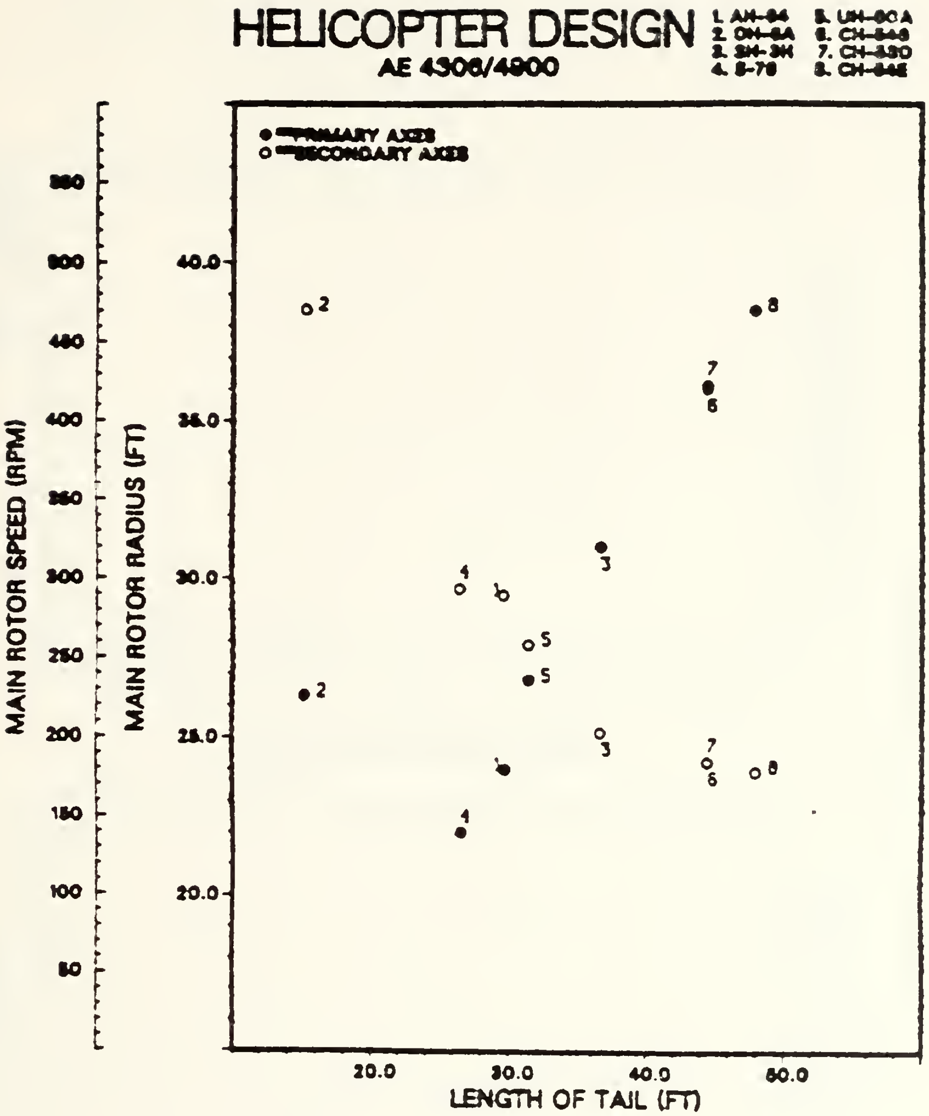

Figure 3.6. Multiple Y Axes Plot (vertical page format)

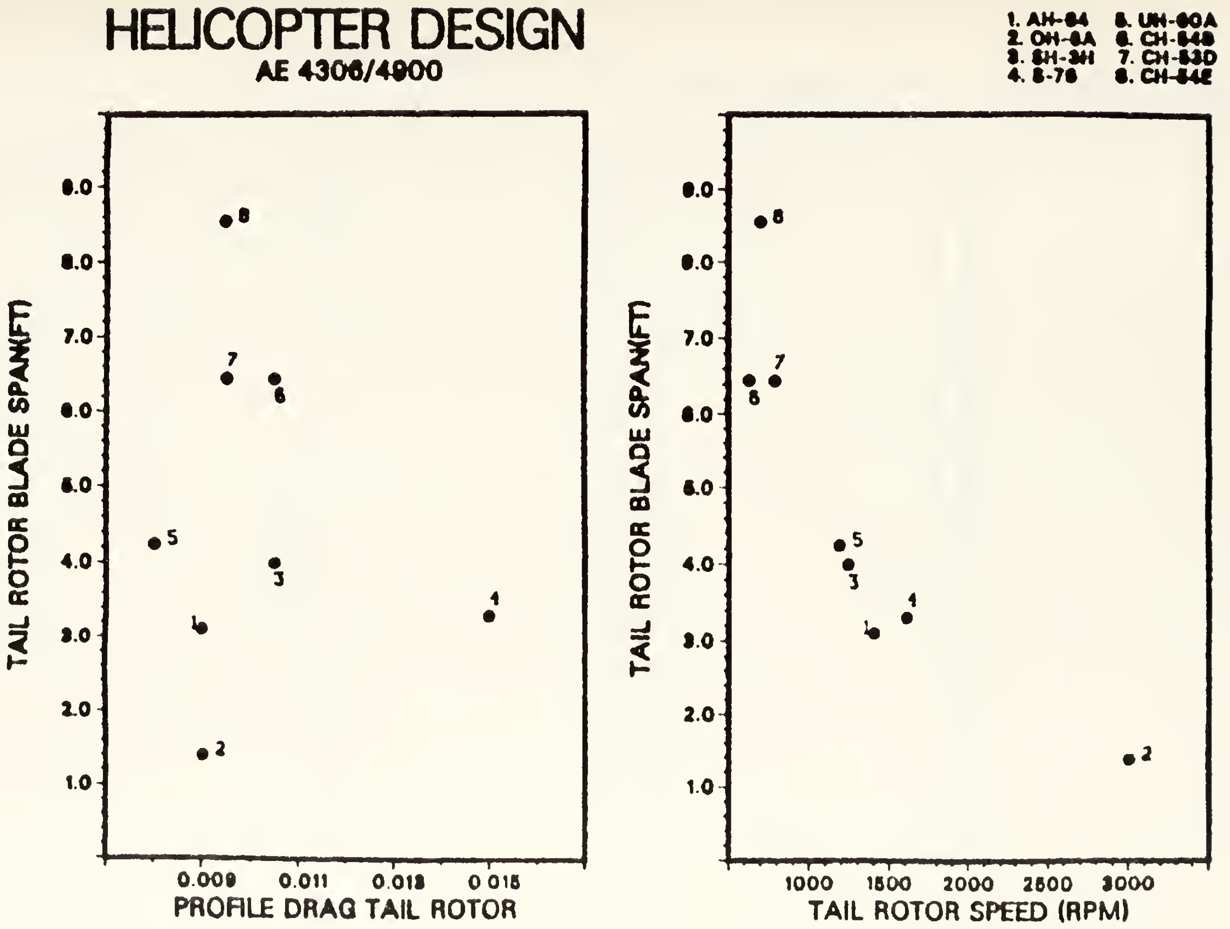

Figure 3.7. Two Plot Option

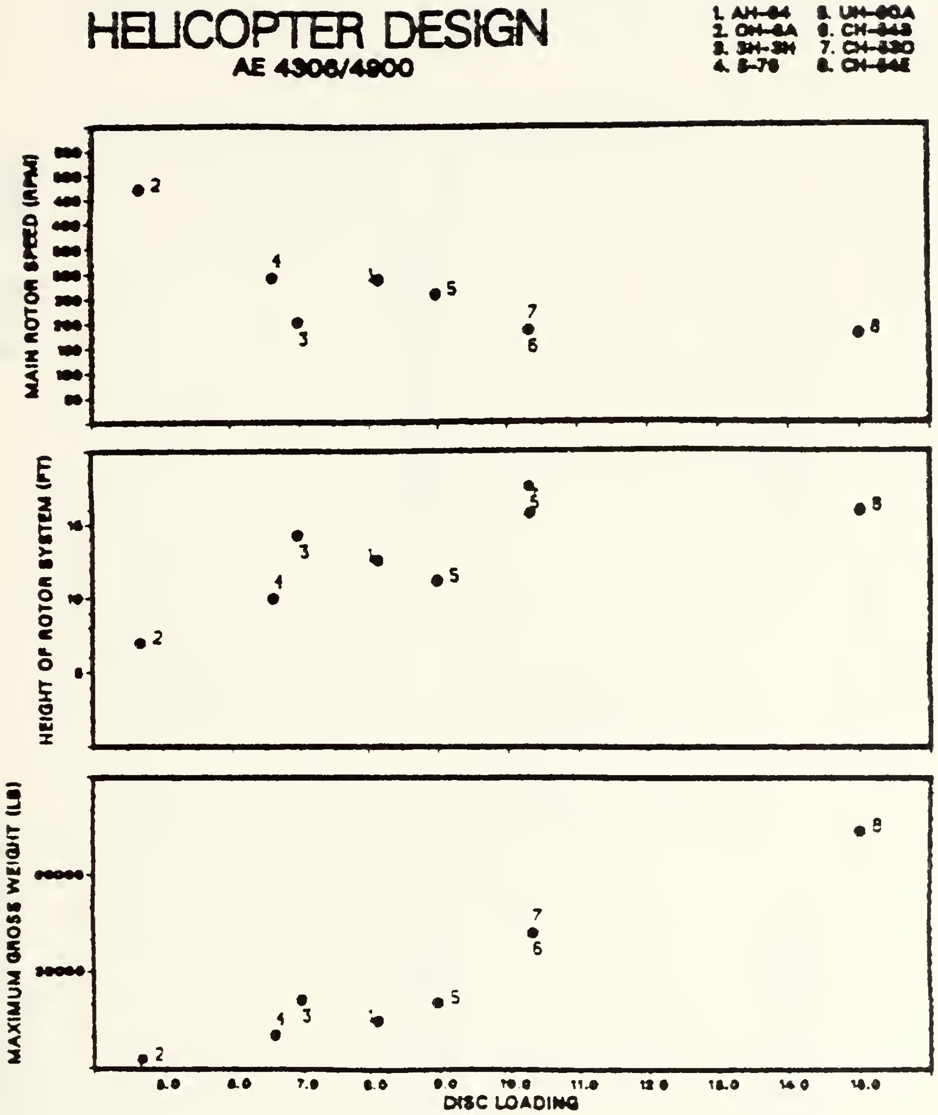

Figure 3.8. Three Plot Option

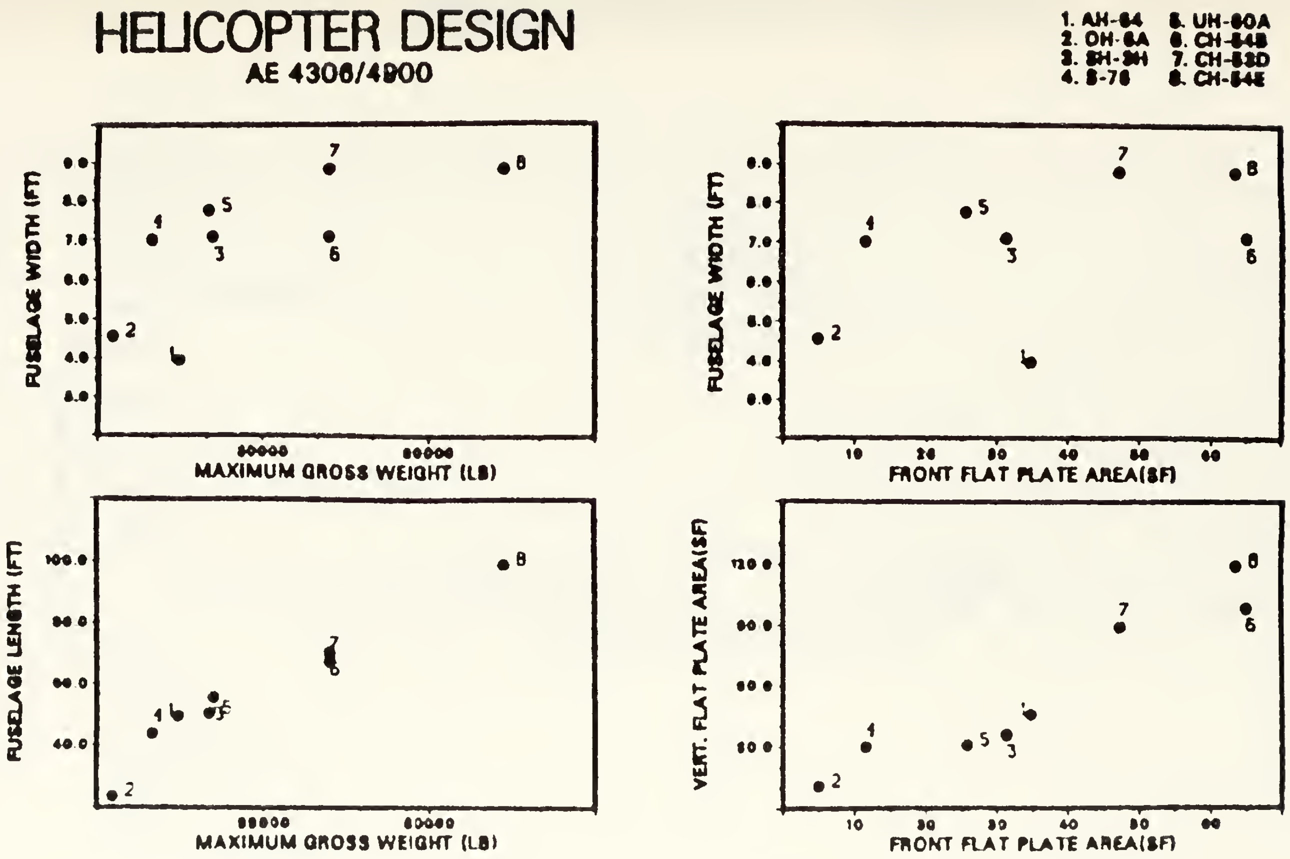

Figure 3.9. Four Plot Option

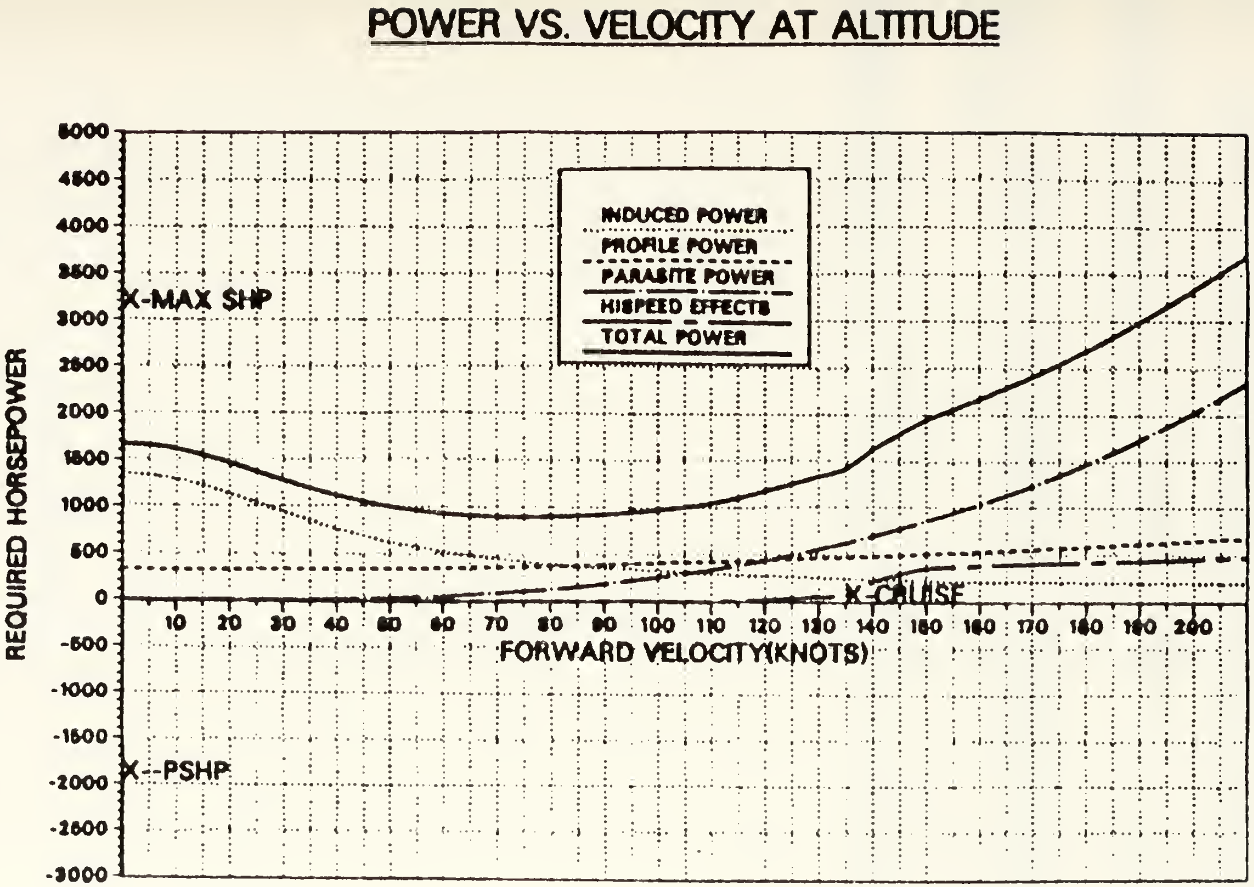

Figure 3.10. Sample Total Power Curve

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